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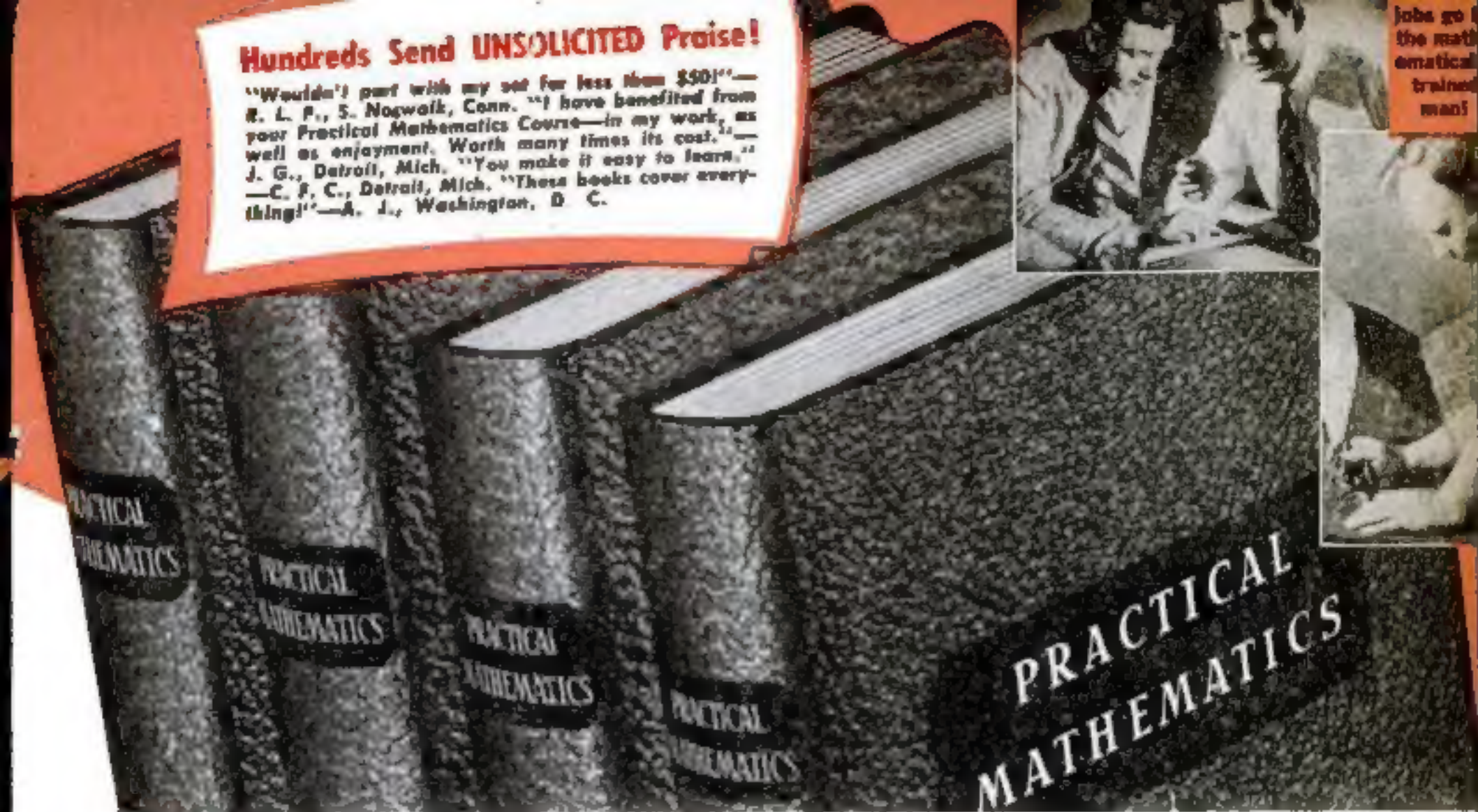
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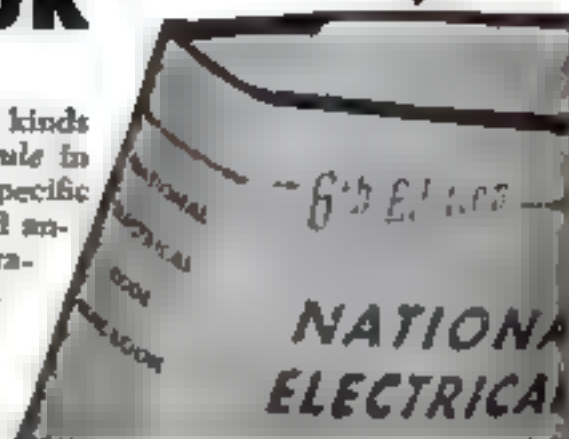
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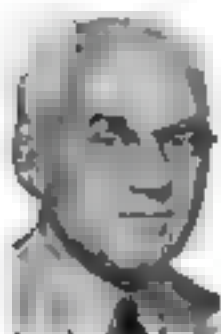
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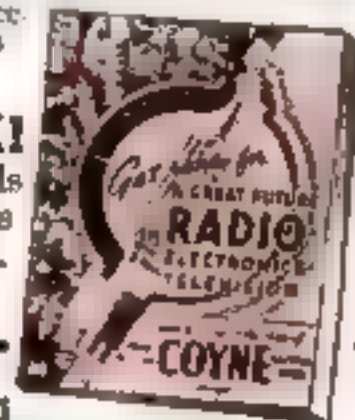
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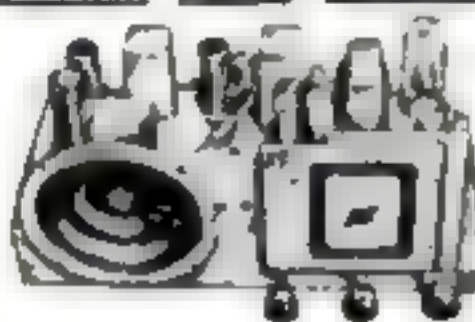
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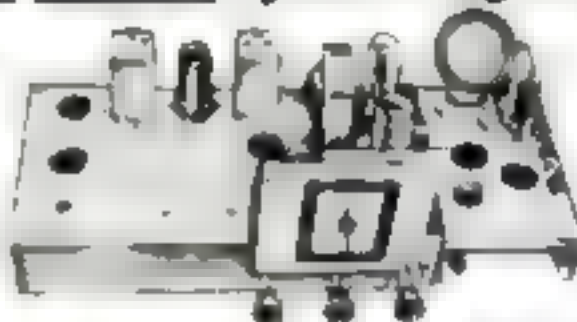
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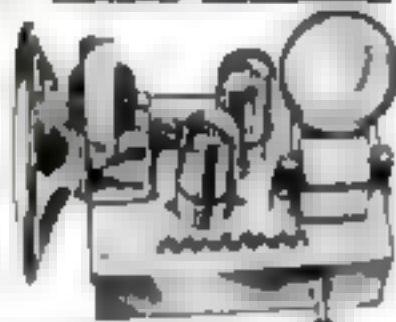
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INVENTORS

Learn how to protect your invention. The U. S. Patent Laws provide that any new and useful art, machine, article of manufacture, or composition of matter, or any new and useful improvement thereof, may be patented if the act of invention is involved. Therefore, every inventor with a valuable invention should take advantage of the Patent Laws and proceed for patent protection in order to safeguard his rights.

A patent gives the inventor the exclusive right to prevent others from making, using, or selling the invention claimed in the patent for a period of seventeen years.

The Patent Laws were enacted for the benefit of the inventor to give him protection for the features of his invention which are patentable. These features must be properly and concisely set forth and claimed in a formal application for patent, in order to comply with the requirements of the U. S. Patent Office. For that reason, the Patent Office advises the inventor, unless he is familiar with such matters, to engage a competent registered patent attorney or agent to represent him. We maintain a staff of registered patent attorneys ready to serve you in the handling of your patent matters.

A specially prepared booklet entitled "Patent Guide for the Inventor", containing detailed information with respect to patent protection and procedure, together with a "Record of Invention" form will be promptly forwarded to you without obligation upon request.

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Letters

Money That May Save a Life

Sir:

The volunteer fire department here has purchased a resuscitator from the E & J Resuscitator Co., Chicago, Ill. By way of explaining the apparatus to the community we request permission to reprint an article that appeared in your July 1947 issue called "Machines That Breathe For You," by Herbert Johansen.

D. WAYNE ROWLAND
Editor

The Willow Springs News
Willow Springs, Mo.

Willow Springs and its volunteer fire fighters are to be congratulated on their alertness in keeping up with new lifesaving equipment. Glad to help, PS is happy to grant permission to reprint its article.

Rats Rival Readers

Sir:

Will you please mix rat poison into your back-binding glue, so as to make it possible to preserve PS in the attic. I suggest also that PS furnish with every yearly subscription a cardboard or plastic bookcase big enough to take 12 issues.

THOMAS E. KULO

Glenview, Ill.

Better Safe Than Sorry

Sir:

I wish to make a protest about Michael S. Spacek's article on his homemade speed flash in the November issue. On page 201, he makes the statement: "... discharged the condensers by shorting their terminals with a well insulated screwdriver."

This is a very dangerous practice, since at the high operating voltages, terrific currents are released on short-circuit that may melt the screwdriver and throw molten metal into the eyes of the operator.

It is better to disconnect the power supply and then flash the tube, waiting about 15 minutes before opening up the unit. . . .

INVENTORS

Patent Laws Encourage The Development of Inventions

The Rules of Practice of the U. S. Patent Office advise—unless an inventor is familiar with such matters—that he employ a competent registered attorney or registered agent, as the value of patents depends largely upon the skillful preparation of the specifications and claims.

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If an inventor believes he has an invention, a search of the most pertinent prior U. S. patents should be made and a report obtained relative to its patentability. Where such report indicates that the invention appears patentable, in order to secure protection, diligence should be exercised in making application for a patent.

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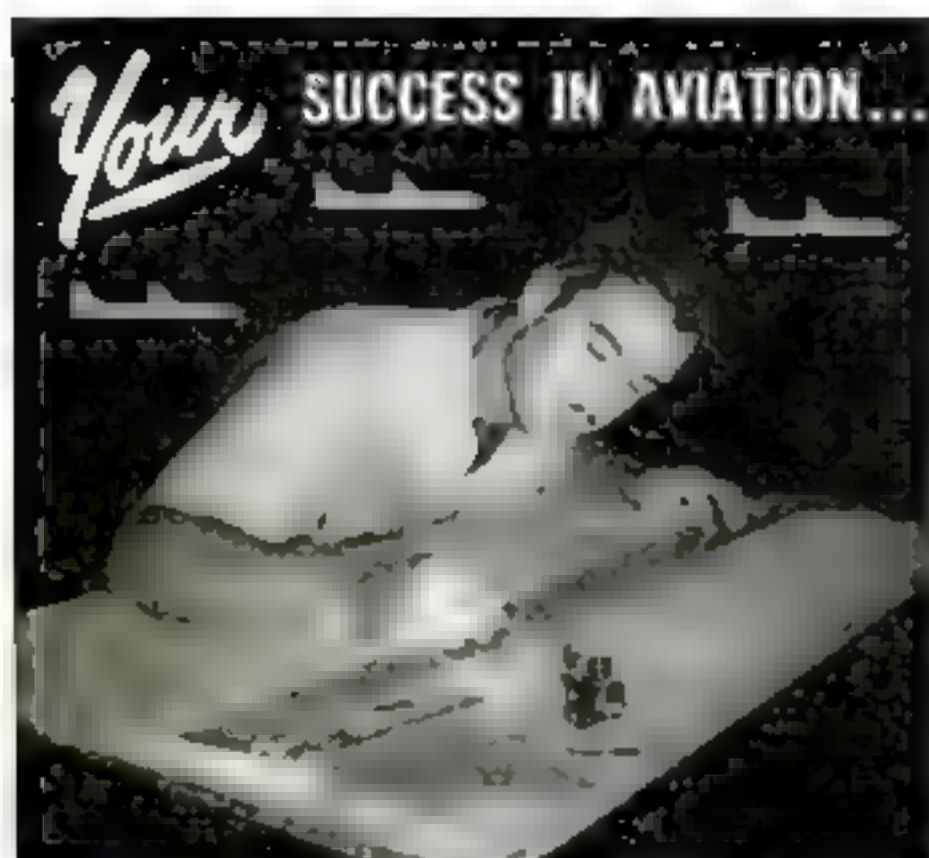
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TRAIN IN MIAMI - AIR CAPITAL OF THE WORLD

I have built one unit entirely of war-surplus equipment. This unit is now being used in a studio here in Brooklyn. I am at present building a second unit with the idea of making it battery-powered. . . .

Lt. WILSON H. HEYDT, U. S. M. C.
Brooklyn, N. Y.

Mr. Spacek reports that the danger of this happening with the particular equipment discussed in the article is extremely slight. To be on the absolutely safe side, however, the method Lt. Heydt describes is the proper one if time permits.

Gus Guesses Right

Sir:

Being intensely interested in cars, I always read Gus's adventures. . . . This one (December) went too far: "Definitely Gus checked the fuel and ignition systems; both were operating properly."

I'd like to know how he managed to find the fuel pump and distributor operative when the camshaft gear was stripped. There might have been an electric pump, but that still leaves the ignition system.

JAN RAVEN

Chicago, Ill.

Martin Bunn, Gus's creator, comes to his character's defense with the following:

Sir:

What Gus did was to disconnect the line from pump to carburetor, find it full, and assume the pump was okay. Then he separated the distributor breaker points while holding the high-voltage coil lead a bit off the block. A juicy spark suggested the ignition system was okay.

I'll admit that neither check was conclusive, but both were a fair enough first check—remember, he'd only just begun. In retrospect, I can see that Gus should have hit the starter with the fuel line off; since gas wouldn't have spurted out, he'd have suspected first the pump and then the camshaft. But his inspiration, you'll recall, solved the problem even faster!

MARTIN BUNN

Right Wrench, Wrong Reader

Sir:

Well nigh unforgivable for PS is its December editorial, showing the wrench

“He’s going places,
that boy!”



“Fred came here as a machinist three years ago. Not too much experience, but with a yen to learn and plenty of ambition. He caught on quickly — so quickly, in fact, that I got a little curious.

“Sure enough, it wasn’t long before I got a report on him from the International Correspondence Schools. He had enrolled in an I.C.S. Shop Practice course and was making better-than-average grades. On the job, he applied what he learned. In fact, he ‘showed up’ many of our more experienced machinists. It paid off.

“When we needed someone to study and recommend the shop equipment for our new plant, Fred got the job. He’s on ‘salary’ now, working here in the front office. When we move, he’ll be put in charge of maintenance and repairs. It’s a big step up, but he’s trained for it — and in this business, *it’s the trained men who get ahead!*”

Thousands of successful “Freds” have acquired their all-important Shop Practice training from the world-famous International Correspondence Schools. If advancement appeals to you, lose no time in following their lead. You can study an I.C.S. Shop Practice course in your spare time — at low cost.

Mark and mail the coupon — it’s your bid for a well-paid, responsible place in the competitive world of tomorrow.



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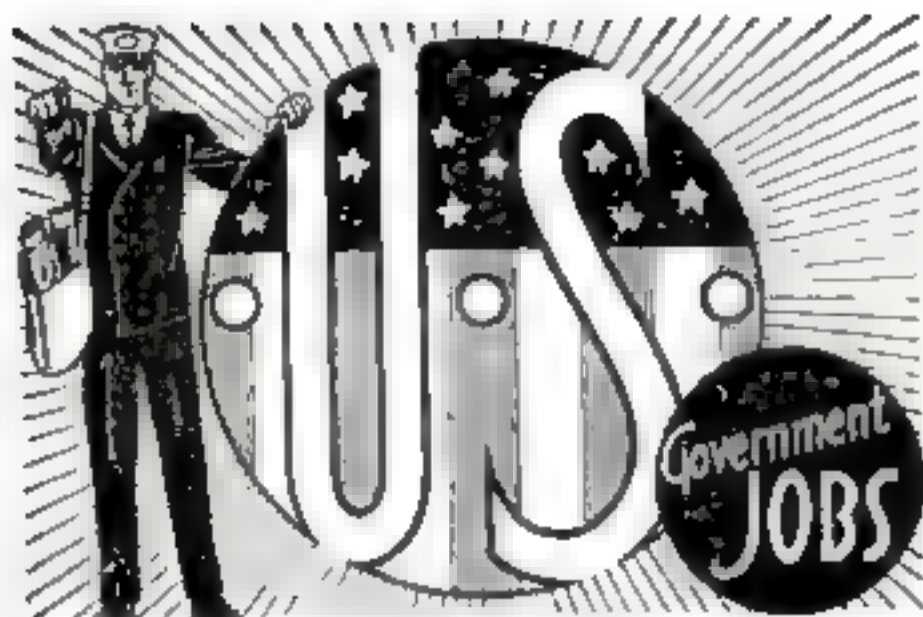
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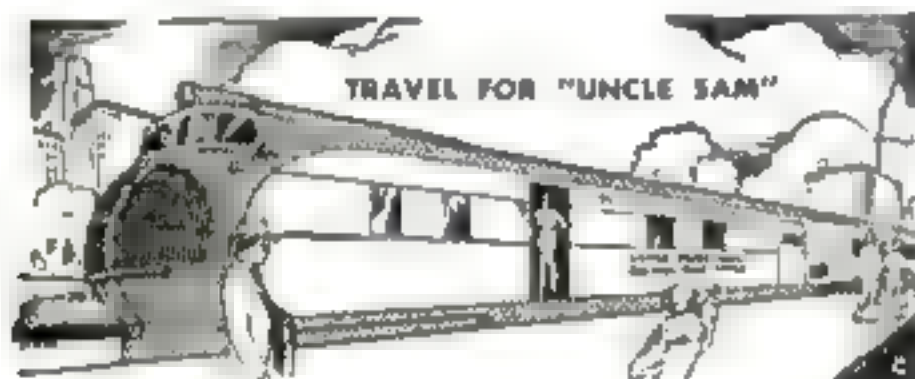
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Railway Postal Clerks get \$2,300 the first year regular, being paid on the first and fifteenth of each month. (\$95 83 each pay day) Their pay is automatically increased yearly to \$3,400. Advance may be had to Chief Clerk at \$3,400 a year. (\$225.00 each pay day.) Male Veterans Only

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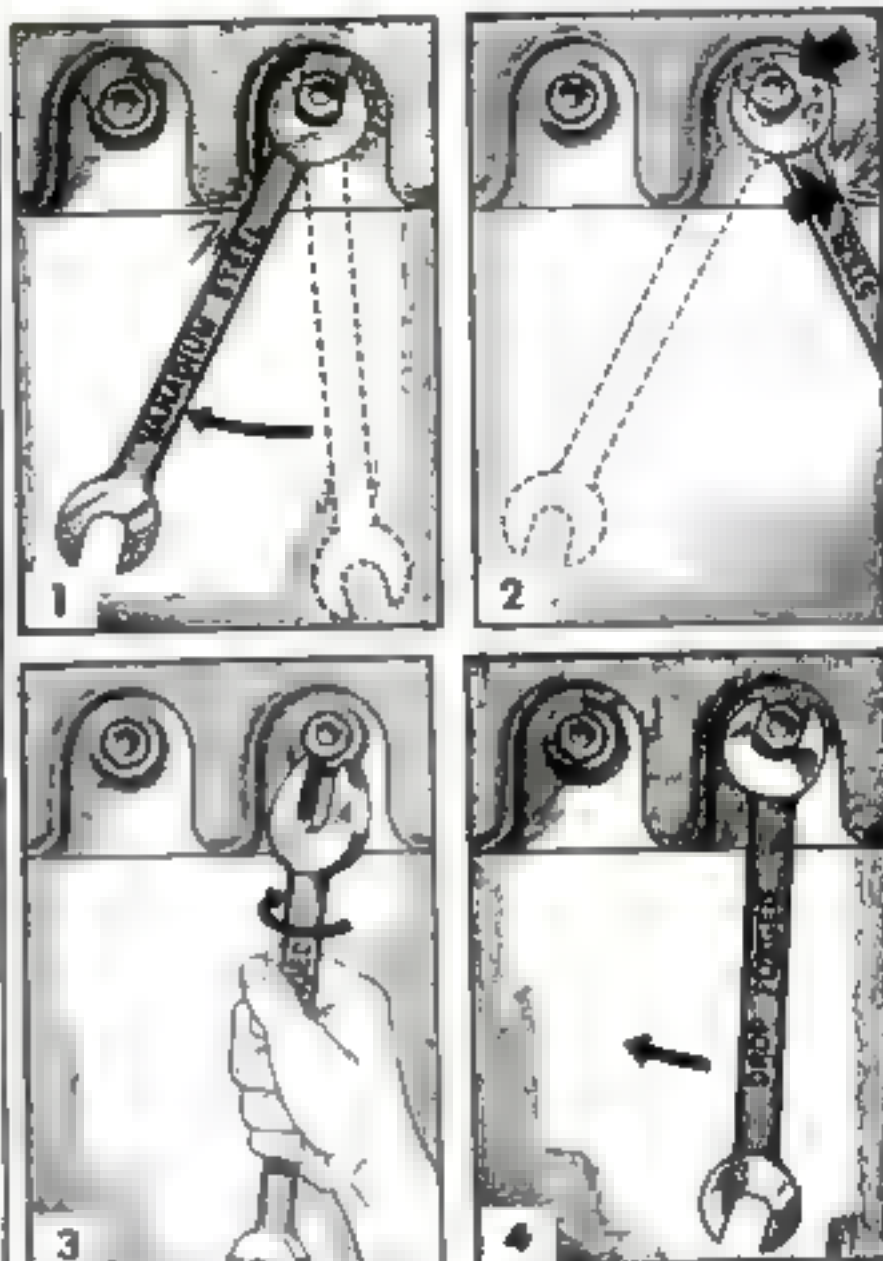
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wrongly applied to the bolt. The short lug of the open-end wrench should be on the same side as the direction of pull. Or does PS just look its own ignorance in the face and say "so what?"

LEO SELTY

Croton-on-Hudson, N. Y.



The General Motors Corp., which should know something about wrenches if anyone does, provides the above drawings to show how the offset head on an open-end wrench can be reversed for greater nut movement at close quarters. In No. 1, the wrench head is turned in the direction of swing; No. 2, the wrench is brought back for second swing but this time will not fit on nut; in No. 3, it is reversed; and in No. 4, it is placed on nut with head turned away from direction of swing, permitting greater movement of the nut than would otherwise be possible.

Thought We Knew Nails

Sir:

In your December issue in the article "Think You Know Nails?" it is stated on page 141 that 10-gauge rod and wire are being drawn into five-gauge wire. This is impossible, for according to the American,

PATENT PROTECTION *for* INVENTORS

A PATENT IS A VALUABLE RIGHT

On the basis of a constitutional provision Congress has established a system under which inventors may secure the exclusive right to prevent the unauthorized use, manufacture and sale of their inventions for periods of seventeen years. The inventor secures this protection by obtaining a patent from the United States Patent Office.

THE United States Patent Office recommends in its Rules of Practice that "an applicant is advised, unless familiar with such matters to employ a competent registered patent attorney or registered patent agent, as the value of patents depends largely upon the skillful preparation of the specifications and claims."

WE recommend that you authorize us to conduct a search through the U. S. Patents pertinent to your invention and submit a report setting forth our opinion regarding its patentability.

Victor J. Evans & Co. has a staff of experienced registered patent attorneys, available to represent inventors in the preparation and prosecution of their cases before the Patent Office. Detailed information and the steps to be taken in obtaining patent protection will be furnished upon request.

FORM BELOW FOR MAILING CONVENIENCE

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A super value for all types of intermittent very low to pumping large to small of liquid in home farm and industrial service. Ideal for home water systems, draining basements, fire protection, etc. Use the pump for watering stock, draining ponds, sprinklers, etc. in shops and factories for all types of pumping service.

MOVE LARGE VOLUME QUICKLY

When operated at 1750 RPM, will pump 42 gallons per minute on a 25 foot head, at 1600 RPM on 32 foot head with pump 48 gal. per minute. May be run with electric motor, gas engine or power take off on tractor.

COMPLETE WITH PULLEY AND MOUNTING BRACKET... READY TO INSTALL

Pump is cast in aluminum housing, extremely machined interior, impeller vanes. Complete with mounting bracket and 3/4" V belt pulley. Shaft carries (in sealed ball) bearings with grease gun fitting. (Max. 1 1/2" threaded in one flange, two 1 inch outlets. Two side of both as necessary. Made for Packard Motor Car Co. for use in Buick-Royce-Merlin Aircraft engines.

GREATEST PUMP VALUE IN YEARS

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Original Cost Approx. \$147.00.

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British, and French scales, 10-gauge wire is smaller than five-gauge. You could draw five-gauge down to 10 but never 10 to five.

JOSEPH PRZENESLO

Joliet, Ill.

Just as curious as Mr. Przeneslo, PS passed the buck along to William Vogel, author of the article, who replies as follows:

Sir:

My mistake. The following is from my notes at Sparrows Point: "wire mill, 20 tons a shift, five to 10 gauge, three drafts, makes eight- or 10-penny nails out of 10 wire." The sentence should have read: "In three drafts, five-gauge rod can be reduced to 10-gauge wire. . . ." Tell your correspondent that I have been assigned to chew 10-gauge wire for five minutes. . . .

WILLIAM P. VOGEL, JR.

Norwalk, Conn.

How Long Did You Say?

Sir:

Under a picture in the article on nails, you state that an eight-inch-square bloom 50 feet long is converted to a four-inch-square bloom 227 feet long. The eight-inch-square bloom contains 38,400 cubic inches. The four-inch-square bloom contains 43,584 cubic inches. Now where did the other 5,184 cubic inches come from?

WILLIAM M. WILSON

Hartford, Conn.

Search us! Since the volume ratio of the eight-inch-square bloom to the four-inch-square bloom is four to one, the four-inch-square bloom should have been given as 200 feet long, instead of 227.

Filing Through

Sir:

Now that my 1947 file of PS is complete, I'd like to read over some of your how-to-make articles and get busy in my shop. But I sometimes have to hunt through 11 copies before I find the one I want. Why don't you publish a yearly index of such articles?

HARRY FRANK

New York, N. Y.

We do. The 1947 Mechanics and Handicraft index is now ready. Order from our Book Department and enclose 10¢.

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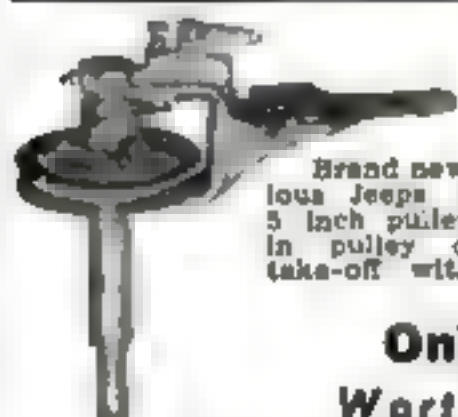
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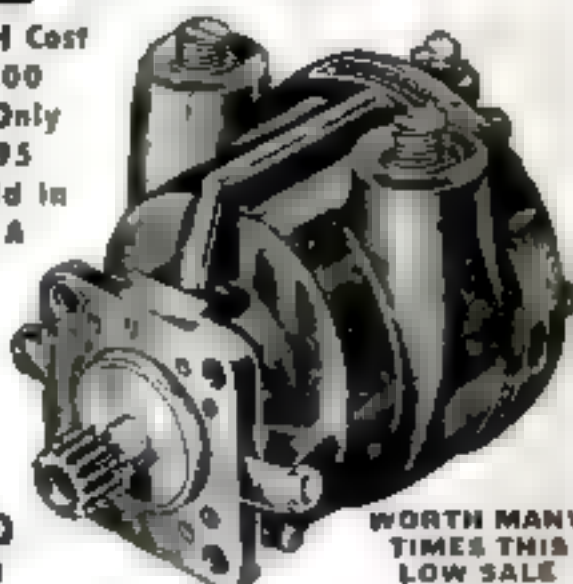
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- 1 R. o. shing stone
- 1 Felt cone
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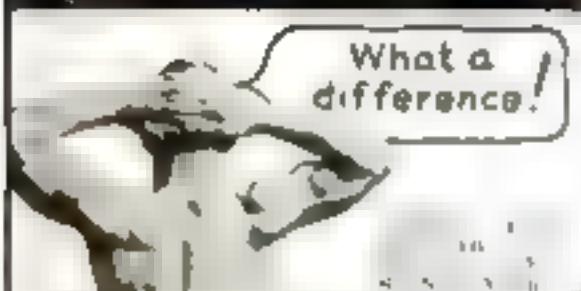
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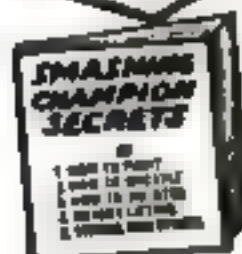
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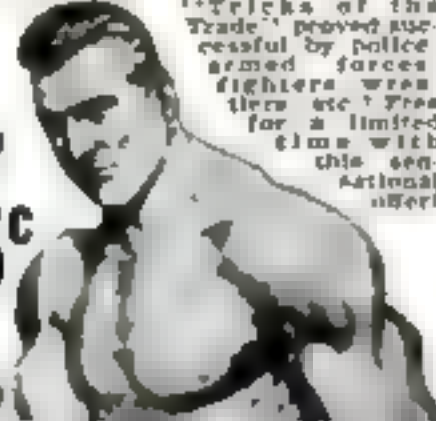
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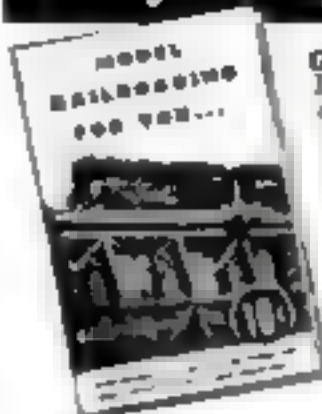
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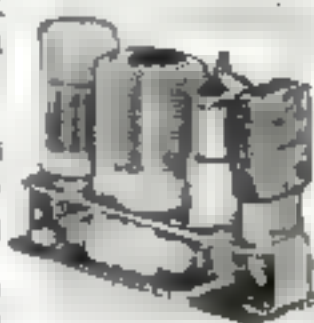
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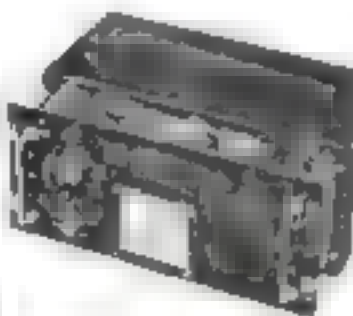
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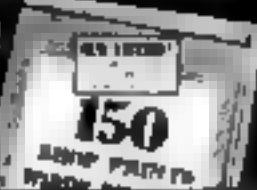
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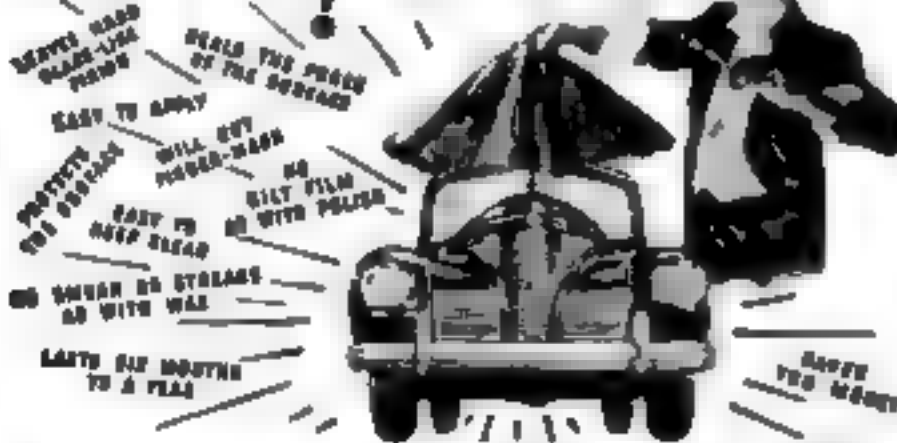
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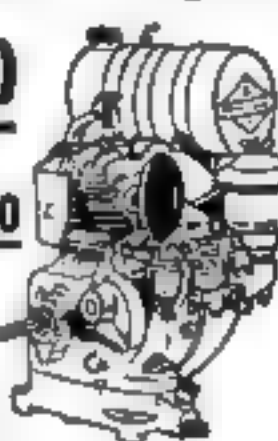
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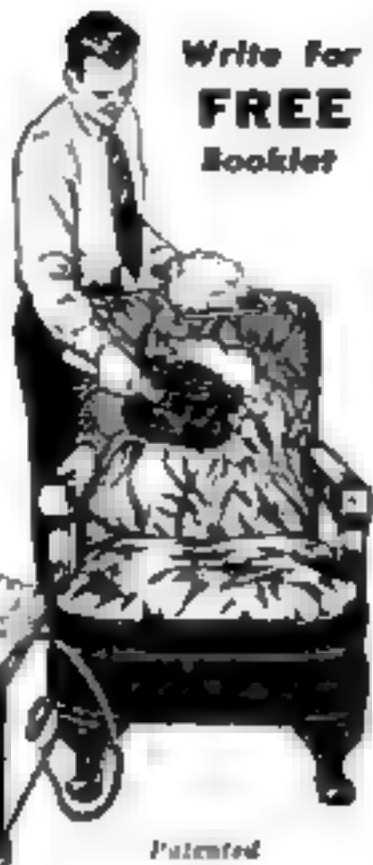
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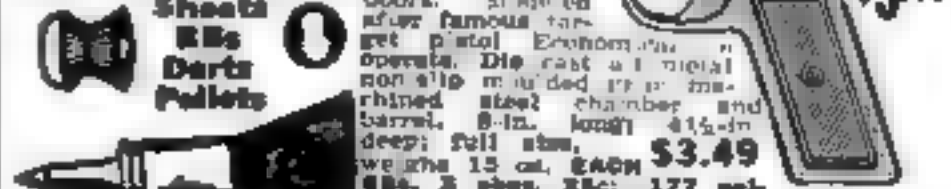
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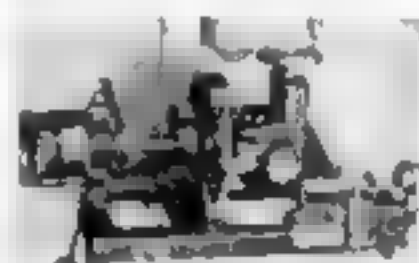
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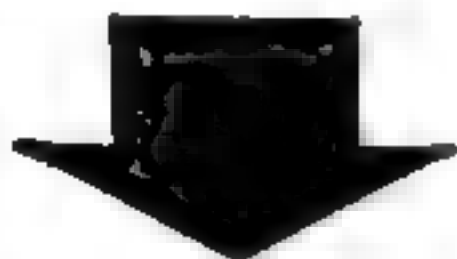
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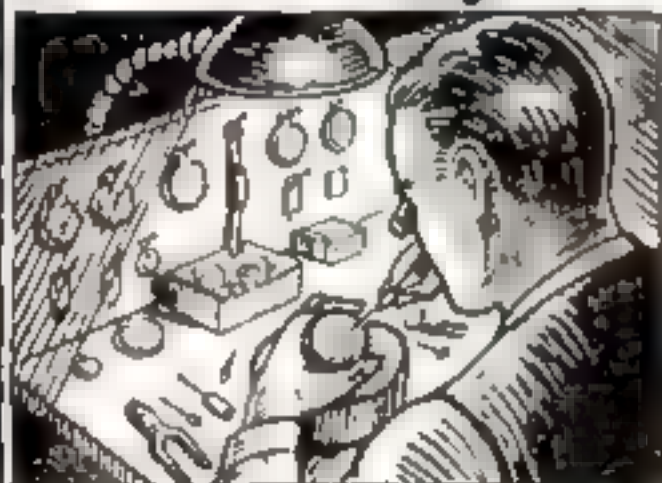
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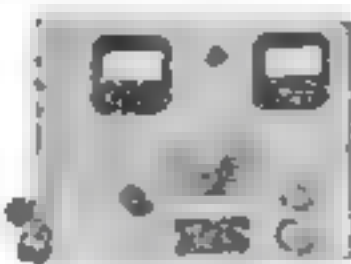


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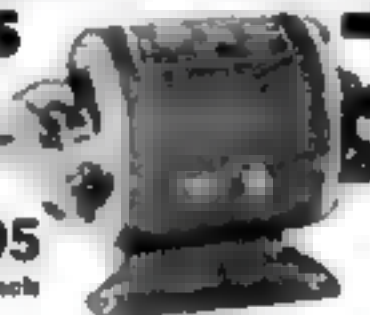
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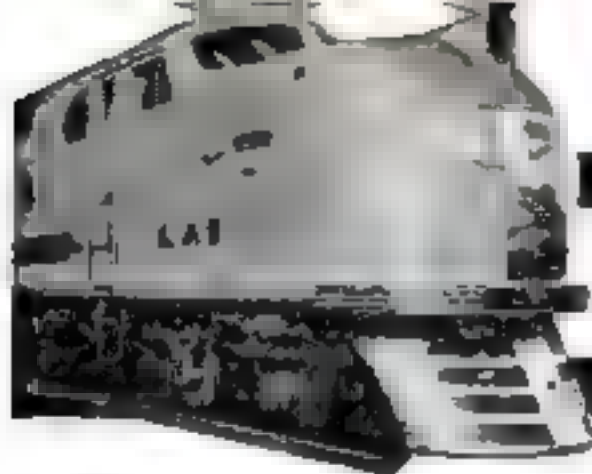
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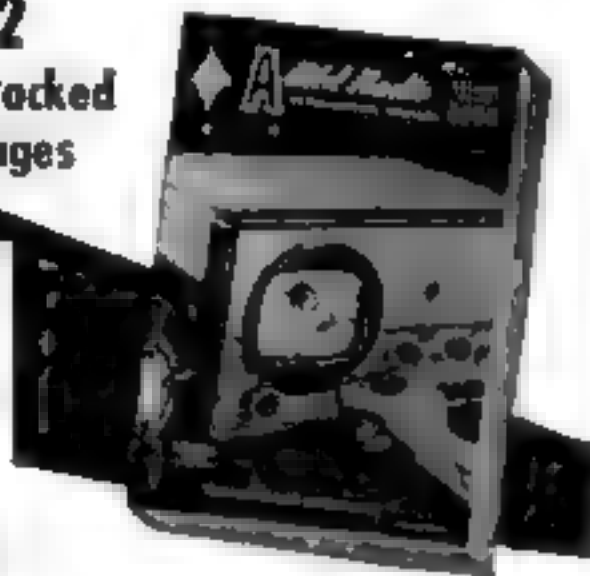
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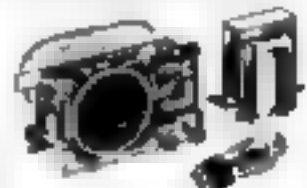
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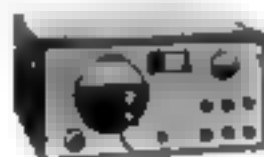
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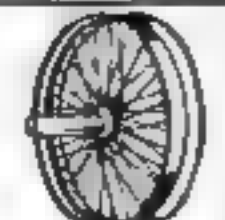
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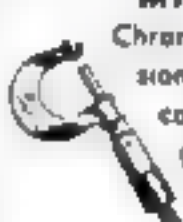
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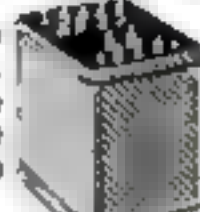
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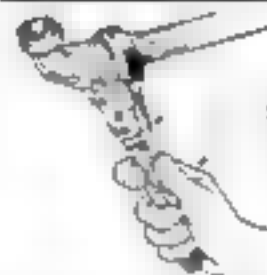
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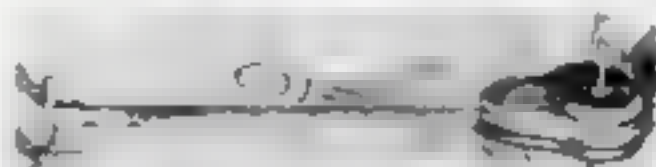
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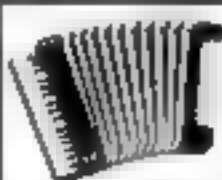
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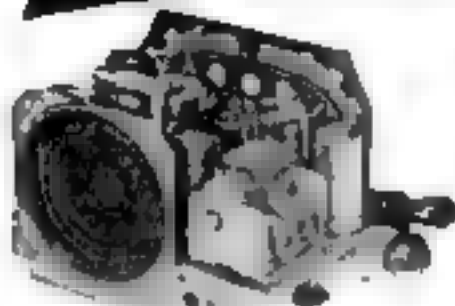
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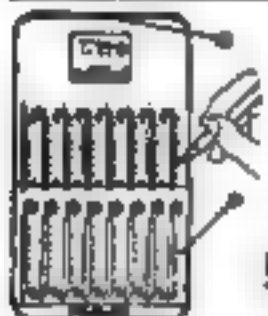
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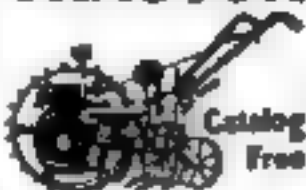
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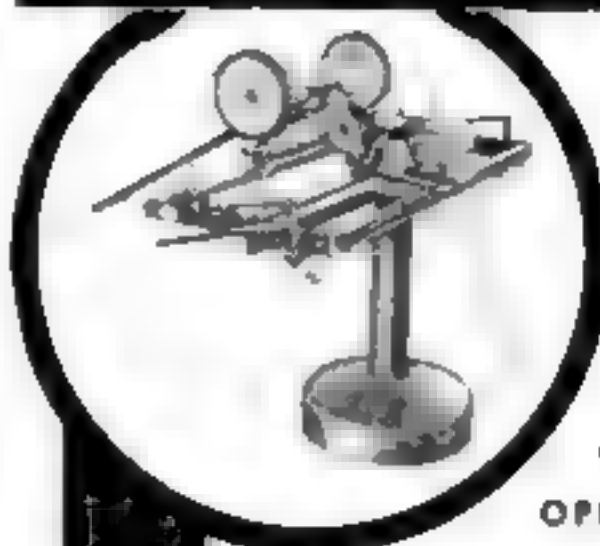
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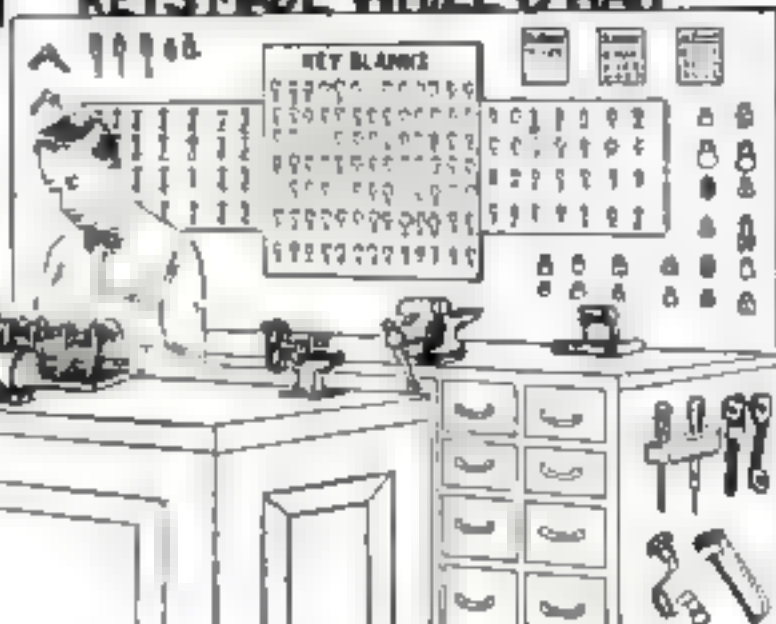
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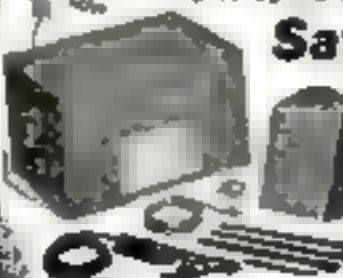
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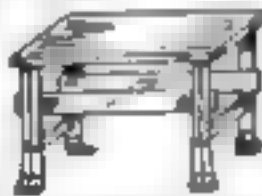
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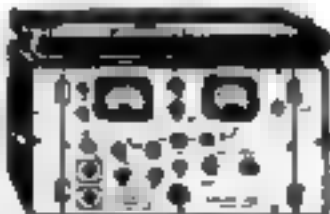
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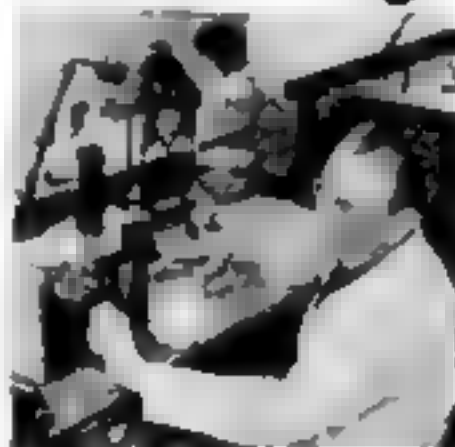
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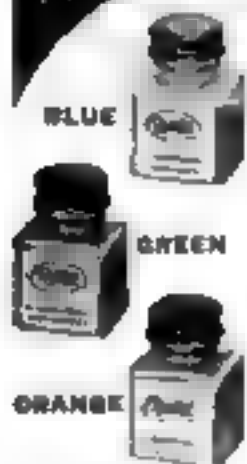
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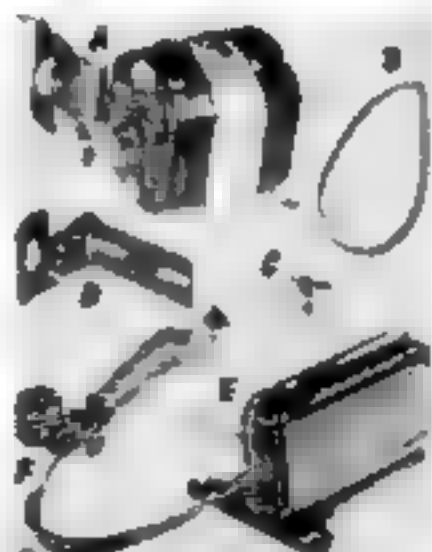
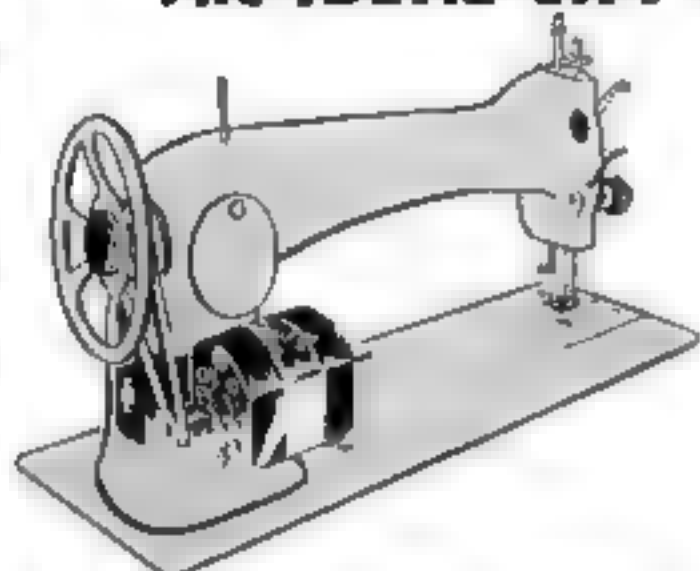
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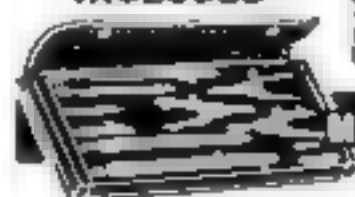
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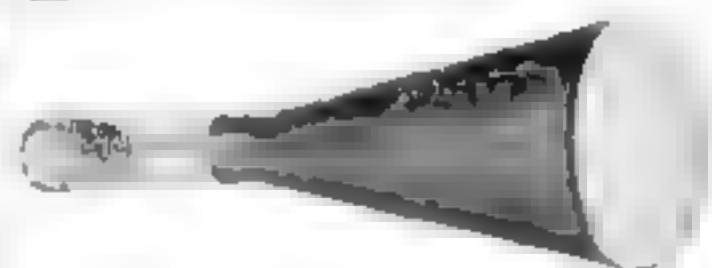
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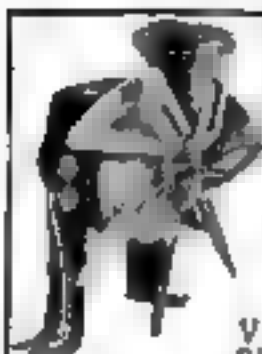
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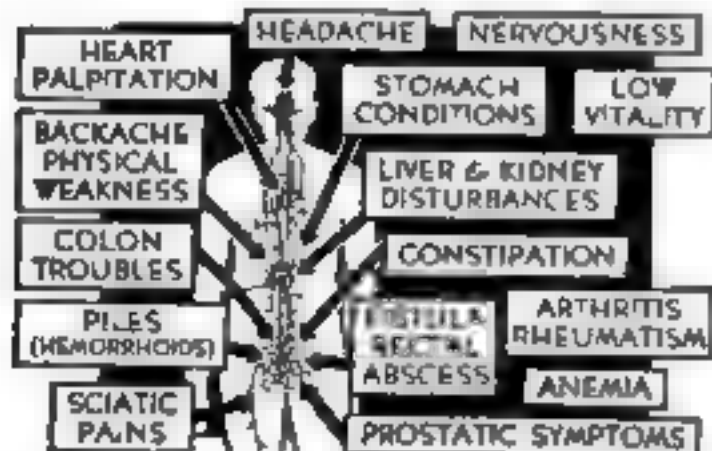
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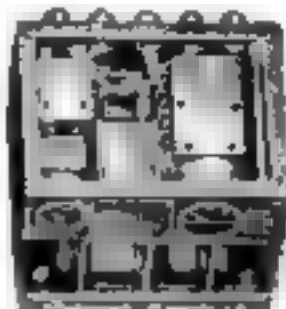
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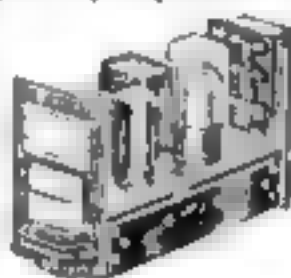
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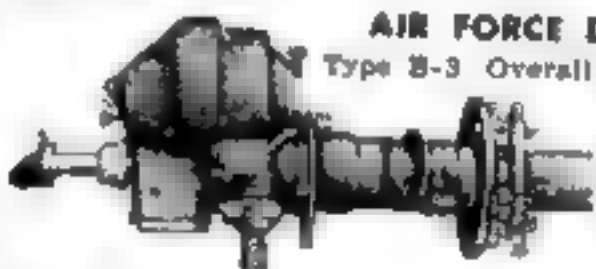
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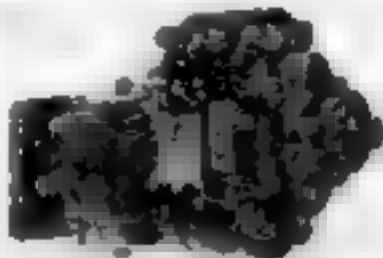


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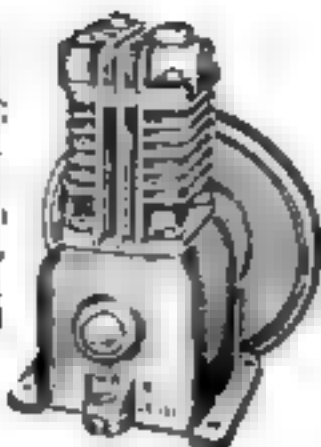
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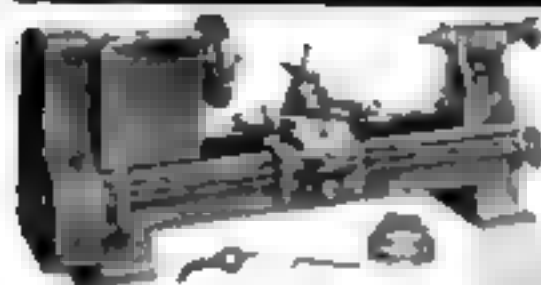
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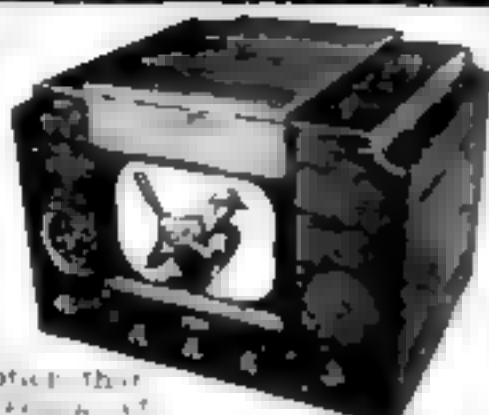
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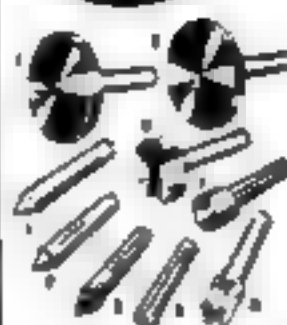
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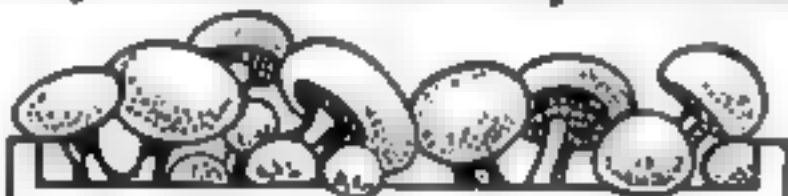


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Enjoy the thrill of picking fresh delicious mushrooms at home. Keep your table supplied for months. The Magic Trays are completely developed with spores. Simply place trays in basement, keep soil damp, mushrooms appear in two or three weeks. Each tray produces for two to four months. Simple instructions with each order. Magic Mushroom Trays are prepared by mushroom growers with years of experience. The same way as those used for commercial production. Trays are 14 x 18 inches. Shipping weight 25 lbs. Orders accepted all states except West Coast and deep South. Mail order now. Enclose check up money order. 4 for \$5.00 10 for \$10.00. Trays sent 24-hour Express or Railway Express.

**HORLOCHER MUSHROOM FARMS
ASHTABULA, OHIO**

WAR SURPLUS LENSES



All-Purpose ELBOW TELESCOPE

\$6.95 8-power field view 13 degrees, 20 minutes. Achromatic color corrected. Can be converted by shipping to a center scope for drill press, jig and tool work. Lens suitable for photography and microscopes. Gov't cost approx. \$150.

3X GUN SIGHT

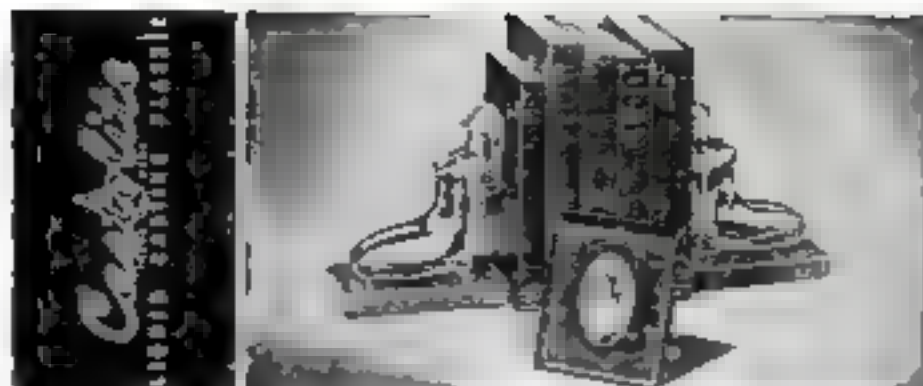


Precision optical instrument powerful achromatic color corrected lens, waterproof, dustproof, shockproof. All brass and brass body. A find for bird and nature study. Gov't cost approx. \$175.00 Each **\$4.95**

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Films Suitable for Study of
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Top quality hand microphone with control button in handle. High y acoustics. Has rubber covered cord and tel. plug. Fine for use on home recorders, public address systems, etc. Brand new - perfect. Shp. wgt. 3 lbs. Stock No. 170. Each \$1.95

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Regulation two-piece Army Mess Kit with folding knife, spoon, fork, perfect. Weight 2 lbs. No. A110-Ex. 69c

CANTEENS

Reg. U. S. issue canteen. Plastic screw top, changed to body 5 gals. used but perfect. Wgt. 1 lb. 137 Stal. 69c

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A. J. metal folding handle. Wgt. 1 lb. No. A130 Each 25c

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Only rubber. But an excellent. No. 930 Each 49c
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Heavy Duty Rubber Gloves

Brand New
Extra heavy extra long Brand new high quality rubber for work and extra long designed for heavy duty work. Ideal for work in cold weather. Perfect in handling chemicals and in handling hot liquids as in auto. A real bargain at the low price. Stock No. 295-79c Per Pair Only

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100 records of modern dance, jazz, blues and many selections. No two are the same. Name bands and artists included. In the future in the past. Guaranteed perfect. Wgt. 2 lb. No. A203 30 records \$9.64

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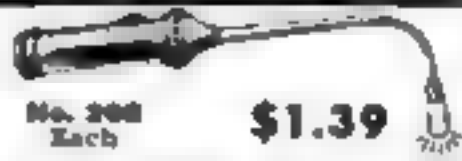
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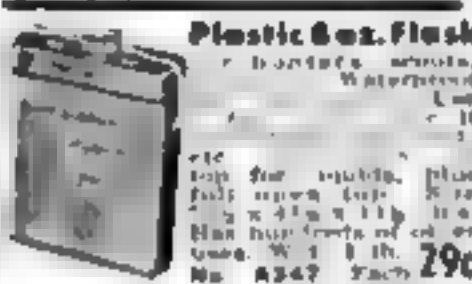


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Extensive selection with 4000 models. Head-phones. Brand new and fully guaranteed. With the latest in radio and phone. A real bargain at the low price. Stock No. A100 Each \$2.95



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A great value for the radio experimenter. Hundreds of value radio parts, new tubes and vacuum tubes and accessories. A real bargain at the low price. Stock No. A1307 7 lb. \$1.79



Regulation Army Pup Tent of 6 ft. x 6 ft. x 6 ft. and 10 ft. x 10 ft. and 12 ft. x 12 ft. and 14 ft. x 14 ft. and 16 ft. x 16 ft. and 18 ft. x 18 ft. and 20 ft. x 20 ft. and 22 ft. x 22 ft. and 24 ft. x 24 ft. and 26 ft. x 26 ft. and 28 ft. x 28 ft. and 30 ft. x 30 ft. and 32 ft. x 32 ft. and 34 ft. x 34 ft. and 36 ft. x 36 ft. and 38 ft. x 38 ft. and 40 ft. x 40 ft. and 42 ft. x 42 ft. and 44 ft. x 44 ft. and 46 ft. x 46 ft. and 48 ft. x 48 ft. and 50 ft. x 50 ft. and 52 ft. x 52 ft. and 54 ft. x 54 ft. and 56 ft. x 56 ft. and 58 ft. x 58 ft. and 60 ft. x 60 ft. and 62 ft. x 62 ft. and 64 ft. x 64 ft. and 66 ft. x 66 ft. and 68 ft. x 68 ft. and 70 ft. x 70 ft. and 72 ft. x 72 ft. and 74 ft. x 74 ft. and 76 ft. x 76 ft. and 78 ft. x 78 ft. and 80 ft. x 80 ft. and 82 ft. x 82 ft. and 84 ft. x 84 ft. and 86 ft. x 86 ft. and 88 ft. x 88 ft. and 90 ft. x 90 ft. and 92 ft. x 92 ft. and 94 ft. x 94 ft. and 96 ft. x 96 ft. and 98 ft. x 98 ft. and 100 ft. x 100 ft. and 102 ft. x 102 ft. and 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Ingenious New Technical Methods

To Help You
Simplify Shop Work



Metal Turning Made Easy with New Simplified Tool!

A new tool called "Tru-Turn" makes possible the conversion of drill presses, woodturning lathes, or grinder stands into tools that will turn and cut-off steel, bronze, copper and aluminum. The "Tru-Turn" tool shown above is mounted on a Buffalo Drill Press, Spindle Size.

The "Tru-Turn" tool is easy to operate and cuts and turns bar stock of steel, bronze, copper and aluminum measuring $\frac{1}{4}$ ", $\frac{3}{8}$ " and $\frac{1}{2}$ ". Its built-in micrometer permits adjustments that give tool-room accuracy to 1/1000 of an inch.

Small tool shops as well as all types of repair shops and garages find the "Tru-Turn" ideal for cutting long pieces of bar stock into desired lengths. Also, home craftsmen are able to produce accurate, highly finished precision-machined parts from metal even without previous training.

Accurate, precision work is also easier to do when tension is relieved by chewing gum. The act of chewing seems to make the work go easier, faster—thus helping on-the-job efficiency. For these reasons Wrigley's Spearmint Chewing Gum is being made available more and more by plant owners everywhere.

*You can get complete information from
Millbolland Screw Products Corp., 132 West 13th Street
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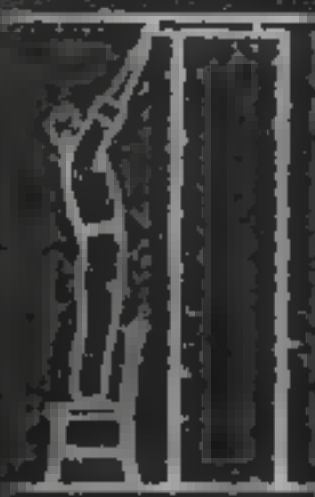
Tru-Turn Tool



AC-59

The Voice of Science

Science is the PRACTICAL approach



YOU hear it every day . . . "the scientific approach." One man says he's "scientific" when he gets enough right answers from Lady Luck. Another waves away science as theory, says *he* is "practical." He's the man with the built-in boat in his cellar.

What is this "scientific approach" anyway? Isn't it just good guessing? Partly—but *orderly* guessing. Call it double-header thinking. Peeling down the problem to get the right questions; then looking for the right answers—according to plan.

Some people have trouble getting answers because they simply don't know what they want to know. Others grope for the answers like a sleepy man in a bathroom feeling for the light switch that's on the other wall.

* * *

Here's a sample of the scientific approach that might come in handy. You need a short partition in a room, a cabinet would be fine. But how anchor it when the landlord is fussy about nails? Simple. Rock in a cabinet whose longest dimension (its diagonal across the end) will clear the ceiling as you push it into place. Then slide in a board or a box to fill the gap. Pad the top to protect the

ceiling; fasten the filler block to the cabinet. Go ahead and lean against it.

If you have a 9-ft. ceiling, the tallest cabinet you can get in under it will be 9 ft. on the diagonal. If the cabinet is 2 ft. deep, your cabinet will be about 8 ft., 9½ in. high. Your filler block, therefore, will be about 2½ in. thick. Now you've got a thing 9 ft. high. It *can't* fall over because its diagonal is now about 2½ in. longer than 9 ft.

We know this because about 2,500 years ago a Greek named Pythagoras proved it out. He figured out the square of the long side of a right-angled triangle was equal to the sum of the squares of the other two sides. It is: always.

Sure, the whole thing can be done by rule of thumb, but this scientific approach is actually quicker and easier than cut-and-try. And some things cannot be dry-run. Science makes it possible to build things on paper. To know before it's too late that the boat will pass the angle of the cellar stairs. And that the cabinet snugged against the ceiling will go in—and not come out.

Perry Gilkerson



RCA Laboratories' "Chamber of Silence"—proving ground of tonal quality in radio and television instruments.

Ever hear SILENCE?

You walk into an eerie room. The door swings shut and you're wrapped in a silence so complete that it's an effort to listen. Sound in this vault-like cavern is reduced to the minimum of hearing.

But even *silence* has a sound of its own. Faintly you hear a subdued hiss; sometimes a soft hum. Scientists have suggested this may be the "noise" of molecules hitting the eardrums. Others wonder

if it is caused by the coursing of the body's bloodstream.

When acoustic scientists at RCA Laboratories want to study the actual voice of an instrument, they take it to this room. What they hear then is the instrument itself—and only the instrument. They get a true measure of performance.

Information gained here is part of such advances as: The "Golden Throat" tone system found only in RCA Victor radios and Victrola radio-phonographs . . . superb sound systems for television . . .

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Research at RCA Laboratories moves along many paths. Advanced scientific thinking is part of any product bearing the names RCA, or RCA Victor.

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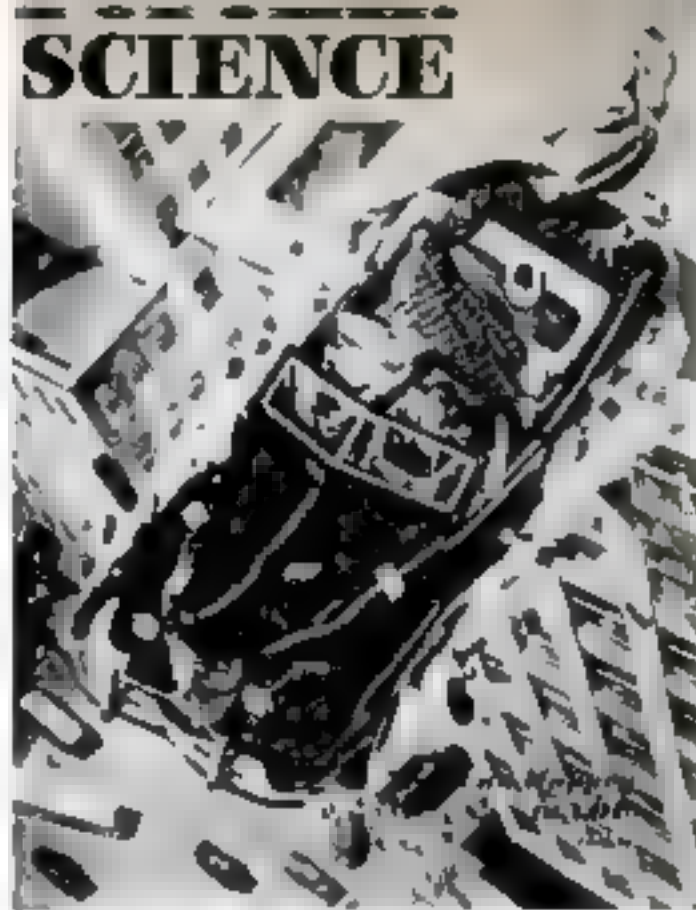


Night Flight to Nowhere . . . Heading through a canyon in a darkened cockpit, this pilot has nothing to worry about except better night vision for other fliers. Cockpit and canyon are make-believe, as shown in inset, they were devised by Boeing to test instrument-illumination systems. In a light-tight room, pilots look from glowing instruments to a vellum "sky," try to spot movable trees on the canyon walls to see how long it takes their eyes to become adapted to conditions beyond the windshield.



This Can Happen to YOU...

This month's cover painting is an illustrated statistic. Driving 30 miles an hour is as dangerous as driving on the roof of a high building! If you hit another car head on going at the same "safe" speed, it would be like driving off a nine-story building.



Good Driving Is a Habit

...How to teach your family the Seven Keys to Safety

***By Devon Francis and
John F. Stearns***

THE driver of a suburban bus outside Detroit was rolling along at a moderate rate the other day when suddenly he hauled on the wheel and swerved. The maneuver was puzzling. Except for some snow-covered cars parked by the right-hand curb, the road was clear.

As I stepped off the bus I asked him about it.

"Oh, that!" he replied. "Well, as we came up to that line of parked cars, I saw the snow on the hood of one of them begin to slide off. I figured his engine was running and maybe he was getting ready to pull away from the curb. I wasn't taking any chances."

That bus driver was a good driver. He made good driving a habit. He knew he had to. It's no longer possible to make each move in driving a conscious move. Speeds have become too fast for that. Stopping distances are too great. Safety on the highway

demands practice until the proper reaction in an emergency becomes automatic.

The first thing to teach your family about the operation of the family car is that good driving must be habitual. Good driving includes keeping a constant lookout for what the other fellow is going to do.

Slip into the right-hand front seat of the family jalopy and have your student settle himself comfortably behind the wheel. We'll assume that he knows the rudiments—how to depress the clutch, shift, brake, and steer. Knowing how to manipulate the controls is the least of knowing how to drive. Now let's take it from there.

Pulling from the Curb

Make your student keep his clutch depressed until he has looked backward out of the window and forward up the street for other cars. Don't let him rely on his rear view mirror. It only shows about three-fourths of the road. Explain that to him. You know that, but he doesn't. And watch out for pedestrians, too. Stick out that hand. Other motorists must know what

How to Spot Trouble Before Trouble Comes

A GOOD instructor teaches students to keep an eye peeled for trouble. It's the bad drivers who cause accidents. They are responsible for more than eight out of every 10 collisions. What's the fellow at the wheel of the other car like? Is he inattentive, careless, discourteous? "Driving ahead of yourself"—meeting an emergency before it develops—simply means watching for the numerous clues to bad driving around you. The behavior of a left front wheel can be a warning of a turn in the absence of a hand signal. So can a drop in speed. Now take a look at these cues to trouble.



The sleeper—He's in the next car ahead—probably daydreaming if not worse. It's a sure bet he'll miss a hand signal from the first car. Here absent-minded driving is your cue.



The gabber—Always an accident getting ready to happen, he's a conversational expert on driving, politics, women's hats, and finance. A glance through his rear window gives your cue.



The cigar signaler—Look out! He's going to turn! Oops, sorry, he's just ash-flipping—No! He's slowing down—he is turning. Your cue is obvious. Stand clear of this character.



The stiff-necked starter—He has hardening of the neck muscles. An individualist, he darts from the curb into traffic without looking back. Smoke from his exhaust is your cue.



The southpaw artist—Has a habit of stepping out into oncoming traffic on the day after he has let his insurance lapse. Any door being opened on the left is your cue.

your car is going to do *before* it does it. It's too late after the crash. Ease out, now, in low. Shift carefully, accelerate slowly.

Make your student develop the habit of driving ahead of himself. Say to him, "Imagine you're sitting on the front bumper. You'd keep looking ahead to see what was coming, wouldn't you?" There's a car at the curb. Its exhaust pipe spits a puff of smoke. The engine must be running. Its driver may pull into the street. Ease by, watchful. There's another car parked just ahead of it. Its front wheels are turned out. Is it going to pull away from the curb?

A kid's ball bounces into the street. Use the brake. Don't wait to see if a kid follows. Take that for granted. Slow down.

"Rule Number One at intersections," you

keep his eye peeled for clues to what the other fellow is going to do. Front wheels on the roll telegraph a lot of information. The car coming into the intersection just opposite you is slowing. Its wheels turn just a shade. Its driver is going to make a turn. Easy, that may mean a full stop for you to let him get out of the way.

Stop for a Talk

When you get through the intersection have your student pull over to the curb for a talk. How fast was he going as he approached the intersection? Twenty. That sounds safe. But does he have any idea how far his car would travel in a half-second at 20 miles an hour? The answer is *fourteen feet*. And what's the half-second for? Well,



This was the inevitable result of driving too fast for conditions. Up ahead, two cars collided.

Nine other motorists couldn't stop in time. The cost: seven drivers were injured.

tell your student, "is that a yellow light means slow down. No light at all means slow down. A green light means slow down. At intersections just slow down! It's healthier. Look left first, since the line of cars you'll meet first will be coming from the left. Make it a habit.

"Watch every other car in the intersection and every car that can reach the intersection before you leave it. Some dope in a hot rod may come screeching through. Look at that line of cars to the right now. If one of them tries to pass another one inside the intersection, put out your hand and stop. Let the fool get out of the way before you move. And in stopping, don't jam on the brake. The car behind you may smack into your rear end. That could well-nigh break your neck."

Tell your student to make it a habit to

that's how long it would take him to react to an emergency. Fourteen feet can be the difference between safety and collision.

A moment ago you warned him against drivers who tried to pass within the intersection. Why? Well, supposing he himself tried to pass another car that had slowed down. The other car may have slowed down to let a pedestrian cross in front of him. Could he avoid the pedestrian? Or the other driver may have been looking for a cross street. If he found it, the chances are he would swing hard left. How much chance would he have to avoid a collision? Or the other driver may have spotted a car on the cross street coming in fast. If your student had been passing, would he have been able to stop in time?

Try another intersection. Here, a streetcar going in the same direction stops as you

Meet the Road's Five Common Trouble Makers

LOOK around you. The traffic on any highway is chock-full of lessons on how not to drive. Every day more than 25,000 drivers are involved in traffic accidents costing the lives of upward of 100 persons—almost all due to bad driving. The cost in automobiles destroyed and damaged each year would pay for teaching 40,000,000 people how to drive safely. The American Automobile Association says we should talk about the art of driving instead of the skill of it. Good driving includes: skill, knowledge, attitude, and judgment. These pictures show the commonest violations of the art of driving.



The curve passer—This fellow shares with the hill passer the title of chief jerk on the highway. When he comes along, pull over to the right and slow down. Be smart and let him go by.



The cutter in—You'll find this suicide-minded dope on every highway. There's nothing you can do about this menace except to give him as wide a berth as the road permits.



The mind changer—This bright specimen darts into a turn from the wrong lane. And when he gets hit, he screams that he had the right-of-way. Just slow down and let him by.



The bumper hugger—Any sudden stop and this one smacks right into you. A slow-to-learn-type, he usually sports a caved-in radiator. Here again, slow down. Make him pass you.



The line rider—Loves to miss oncoming traffic by inches. Never heard of the laws of impact. Don't try to cure this fellow by swerving toward him. Just give him lots of room.

approach. Ask your student, "Know what may happen if you barge on into that intersection? Another car may come in fast on you from the left. The streetcar hudes it. What'll the other driver do—go under you, over you, or through you? Get the habit: STOP."

Railroad tracks are intersections too. Roll your student up to a crossing. Where it says stop, it means STOP. Trains use wheels too, and anything on wheels is potentially dangerous. Single track or double track? Look both ways. The tail end of that passenger train rumbling by may hide the head end of a freight a hundred feet away. Wait. You may spend 30 seconds and save your life.

Turning

Practice making turns. Tell your student he must learn a habit of signaling. Make him learn to work his way into the proper lane minutes before he intends to make a turn. He must ease off on the accelerator several hundred feet ahead of his turn. He'll learn that the braking power of his engine compression with the power off is one of his chief assets in car control.

To make that turn he must signal. Say to your student, "put out your hand. For a right turn, you must be in the right lane. For a left turn, you must be in the left lane. That's elementary, but make it a habit. To change lanes you've got to signal. You've got to look behind you for following traffic. You've got to signal again for your actual turn. That's just protecting yourself from the other fellow."

Now for the turn. It's you talking: "Swing left just short of the center of the intersection, if the law permits. That leaves room for drivers coming from the opposite direction who also want to turn left. Complete your turn just to the right of the cross street's center line. See how this keeps the number of traffic lanes you have to cross at a minimum?"

Right turns are money in the bank. Start from the right lane. Complete the turn in the right lane.

Passing

Take your student out on the open road. Here's space. He's got a lot of horsepower under his foot and he aches to use it. If the road's clear, let him. It satisfies an urge.

He's going to overtake cars going his way that are jogging along uncomfortably slow. He wants to pass. What's a safe passing

speed? What's a safe passing distance? Those are hard ones to answer. But maybe this will help:

If your student is going to pass a car going 40 m.p.h., he should have about 1,000 feet—or about 55 car lengths—between him and any car coming from the opposite direction before attempting it. And there's a catch. These conditions hold good if the oncoming car is making about 45. They hold good if the pavement is dry, if the road is straight and level. If the pavement isn't dry, tell him to double his estimate just for safety.

If there's a hill or a curve, tell him to make it a habit to let up on that accelerator and keep his position.

He makes an experimental pass. The car gets by all right, but he cuts in too sharply in his anxiety to get back into the right-hand lane. "Wait," you have to tell him, "until you can see some part of the car you've just passed appear in your rearview mirror. Then ease back into your lane."

There was something else. Did he forget something? He looks blank. Did he look behind before he started to pass to see what traffic was following him? Did he put out his hand? No, he didn't. Let those answers ride on the double zero for the next spin of the wheels without saying anything more. It's effective.

"At night," you can tell your student, "passing is more critical. Make it a habit to allow yourself more room. Be more critical of your judgment of speed. Flick your headlights to tip off the car ahead that you're going around him."

Speed

That speed itch is eating at the ball of your student's right foot. You know it. The needle on the speedometer keeps creeping up. Let him go. Wait until she hits 50. Then tell him to brake to a stop as fast as he can and still keep the car under control.

He starts braking. "Did you look behind?" you ask him. "Did you put out your hand in a slow signal?" No, he didn't. Okay, just a reminder to make it a habit.

As the car snubs to a halt, ask him if he has any idea how much distance he ate up in stopping the car. No, he hasn't. Then explain it to him: "It took you a total of almost a full city block to bring this jalopy to a stop from 50 miles an hour. But there's something even more important—do you know how far your car traveled from the

time I told you to stop until your brakes began taking hold? No? Well, it was 55 feet, more than the width of a city lot. It took you that long to react."

It will help that itchy accelerator foot if he forms the habit of thinking of a car as a huge steel flywheel. The faster it goes, the more kinetic energy it builds up. The kinetic energy goes up as the *square* of the speed. *It's 25 times as great at 50 miles an hour as it is at 10.* The only way that kinetic energy can be dissipated fast is with the brakes.

And here's another valuable habit to form—have him keep thinking of driving conditions. The trouble with most drivers is that they go *too fast for conditions*. Visibility, for instance. There may be fog, rain, or snow. Ever hear of a pilot taking his personal plane off the ground when the airport was fogged in? Okay, take a cue from people who fly airplanes. Even 10 miles an hour

may be too fast under certain conditions.

What's the condition of the road? Ice? Snow? Rain? What's the condition of traffic? Light? Heavy? What's the condition of the terrain? Hills? Hairpin curves? What's the condition of the car? Brakes okay? Headlights bright? What's *your* condition, Mr. Student? Sleepy? Worried and preoccupied?

Remember, teacher, you can't do your job in one lesson. You are trying to form a habit. So short, frequent sessions are best. And watch yourself: don't *you* get excited. Keep your voice deliberately low and calm.

As your pupil progresses, keep him at the wheel longer. Let him get confidence, but when he becomes over-confident, as he will, check him gently. Let him get away with two or three blunders. *Then* tell him.

That's enough for today. Tell your student to turn around and head for home. Whoops! How about a signal for that turn? Remember, make it a *habit!*

END

Seven Keys to Safety



1
Learn to judge conditions: traffic, visibility, road surface, mechanical condition of cars, physical condition of drivers.



2
Don't forget that it isn't how fast you go, it's how fast you can stop. Stopping = braking distance + your reaction distance.



3
Keep one (1) car length behind the other fellow for every 10 miles on your speedometer. Double ($\times 2$) it for wet days. Double that ($\times 4$) for snow or ice.



4
Suspect every pedestrian of suicide.



5
Slow down at yellow lights. Slow down at no lights. Slow down at green lights. Every intersection is a crash point.



6
Signal your intentions. Protect yourself from the other fellow.



7
Expect the worst from the other fellow.

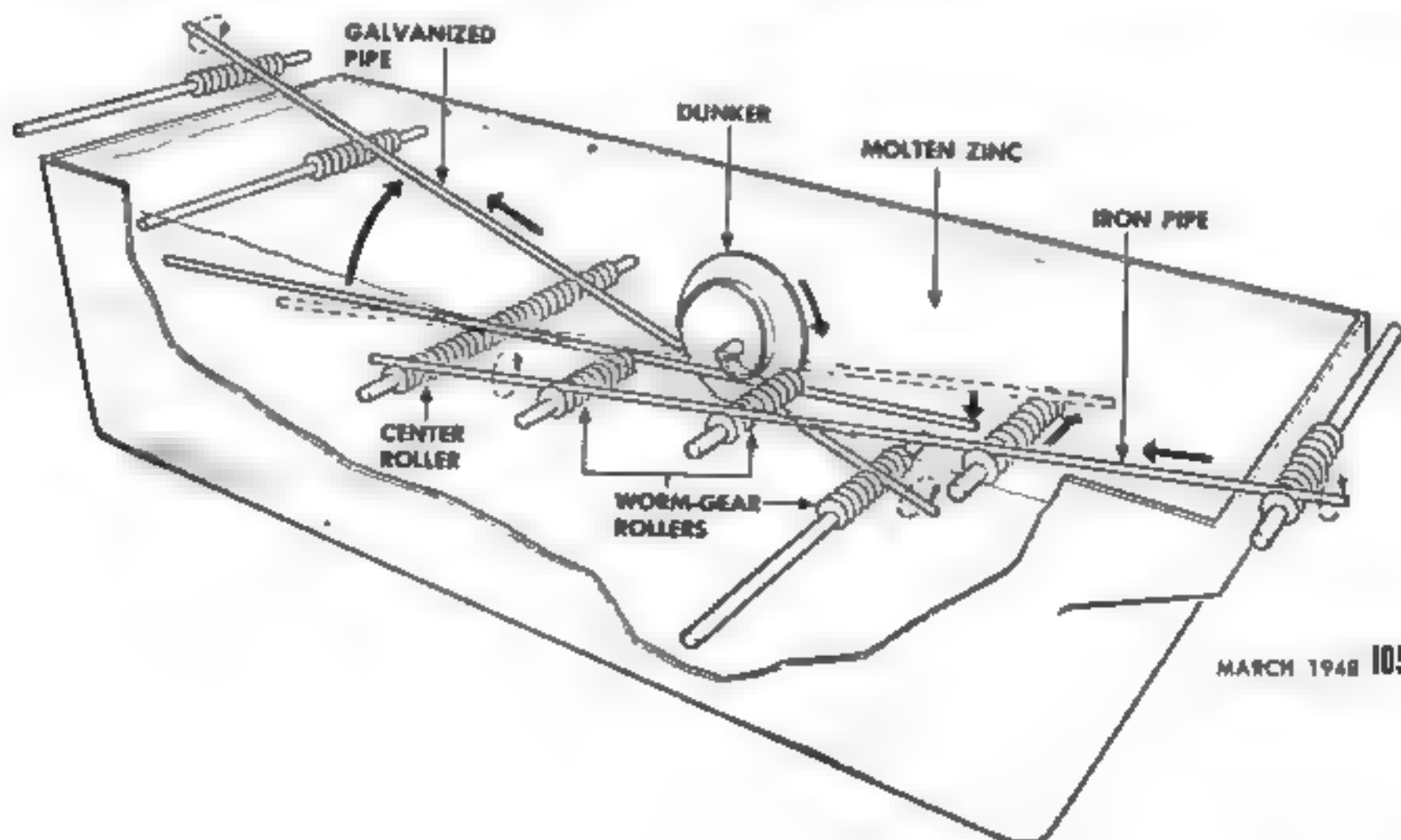


The galvanizer, shown here lifted above its tank, uses worm rollers to move pipe through bath.

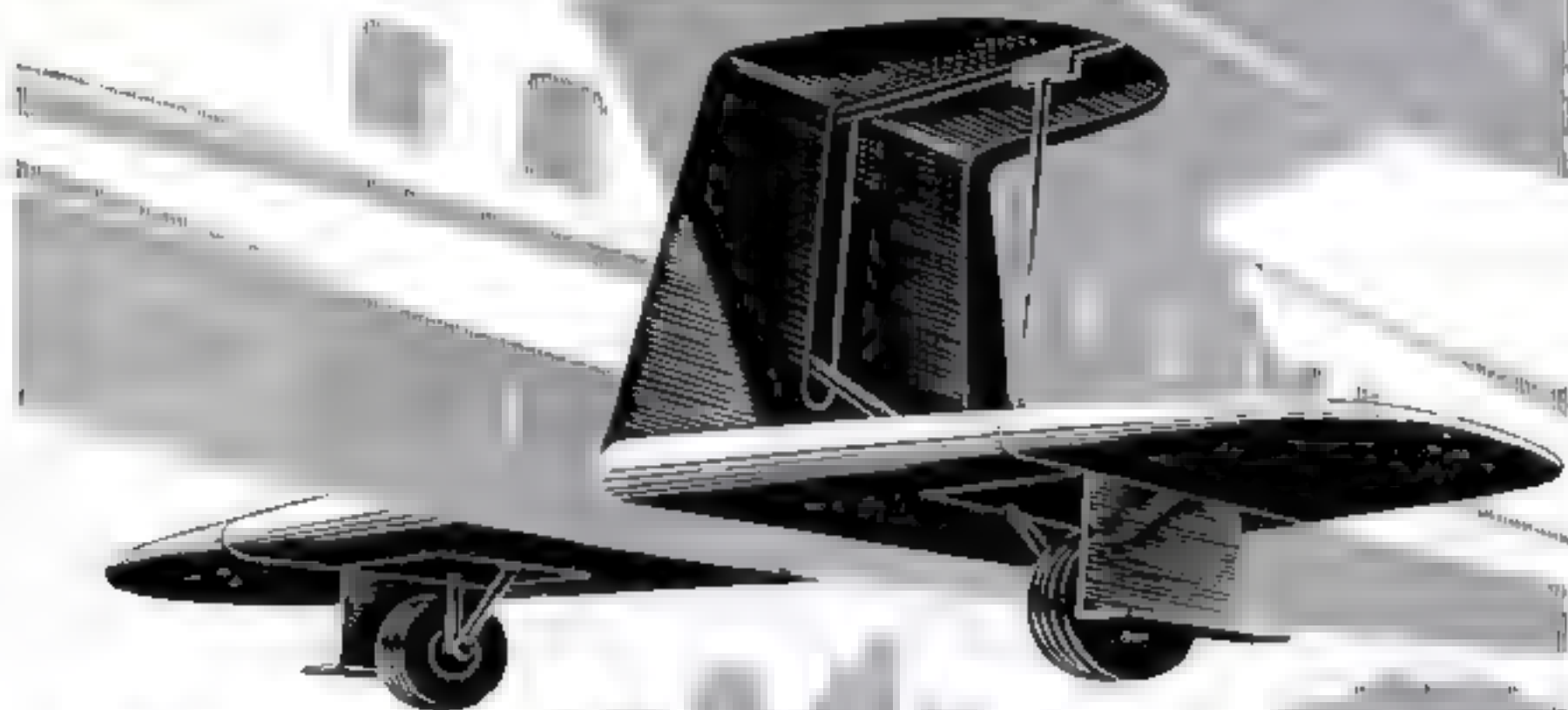
New Galvanizer From Home Shop

THANKS to a home workshopper's ingenious machine, galvanized pipe can now be turned out automatically, in volume, with a bright, even coating of zinc. Paul Ely worked two years on a model in his basement shop, then showed it to his employers, the National Tube Co. Enthusiastic, they halted work on a different unit in favor of Ely's.

The secret lies in a set of worm-gear rollers that keeps the pipe moving through the zinc bath continuously, yet withdraws it so gradually that excess zinc has time to run off. The worm spins the pipe (for uniform coating) and shifts it sideways until it drops off one end of the roller. A dunker cam then pushes the back end of the pipe down into the zinc bath, pivoting it on the center roller. This brings the front end up to an outgoing roller that moves it out of the tank. The process can handle 600 tons of two-inch pipe in 24 hours.



New Ideas from the Inventors



Winged Wheels Add Lift. When this plane lets down its wheels, it also sprouts an extra pair of wings. Patented by Jack S. Conner, of Los Angeles, Calif., the stub

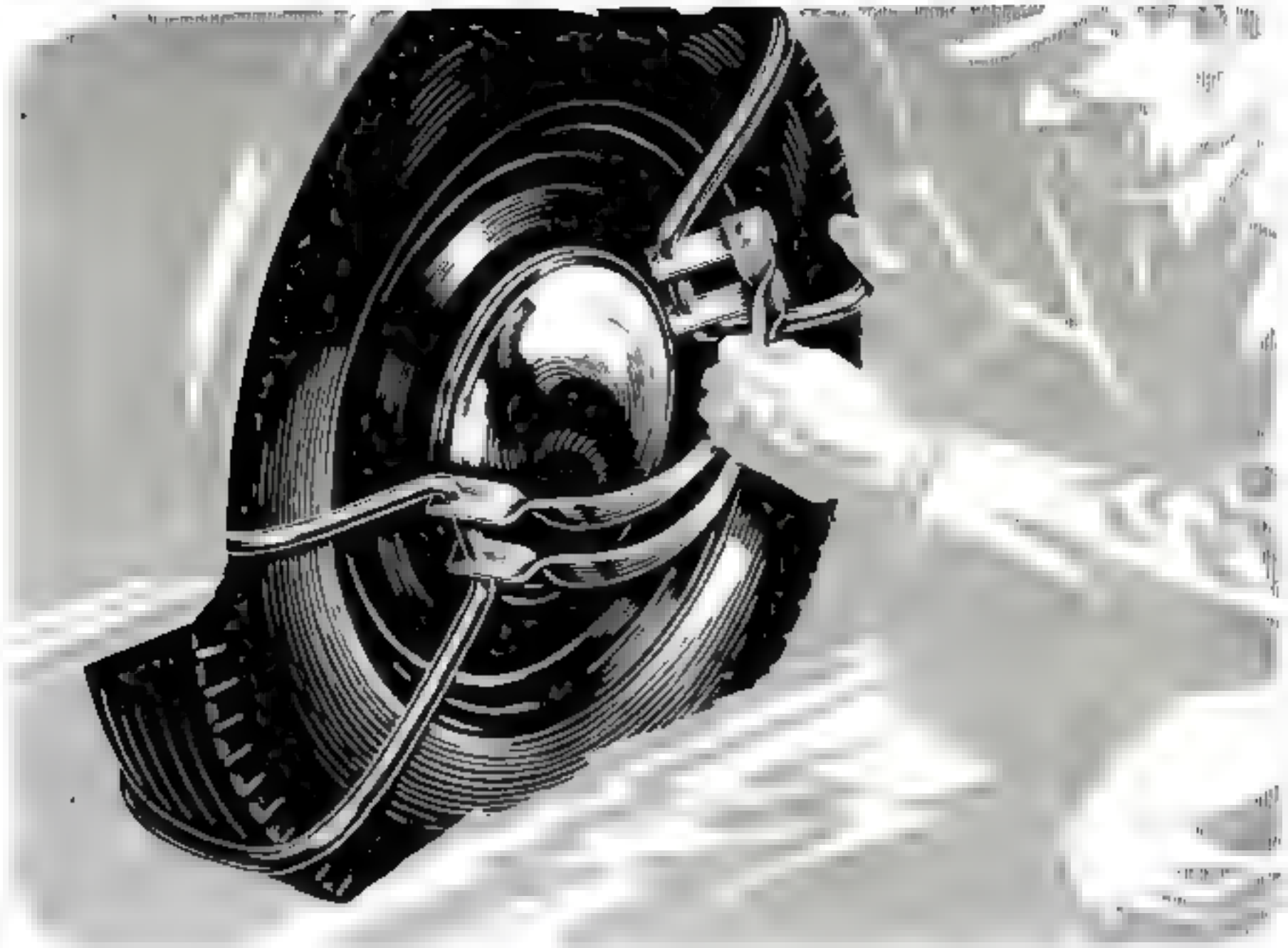
wings are designed to give increased lift for landings and take-offs. Hinged in two sections, they fold half against the fuselage and half into the under part of the main wing.



Gunsight Shows in Dark. If you do much hunting at night, you'd probably go for this self-luminous gunsight invented by Clyde B. Ferrel, of San Francisco. The front sight, marked by a luminous plastic, is centered between two upright bars of the same material on the back of the rear sight.

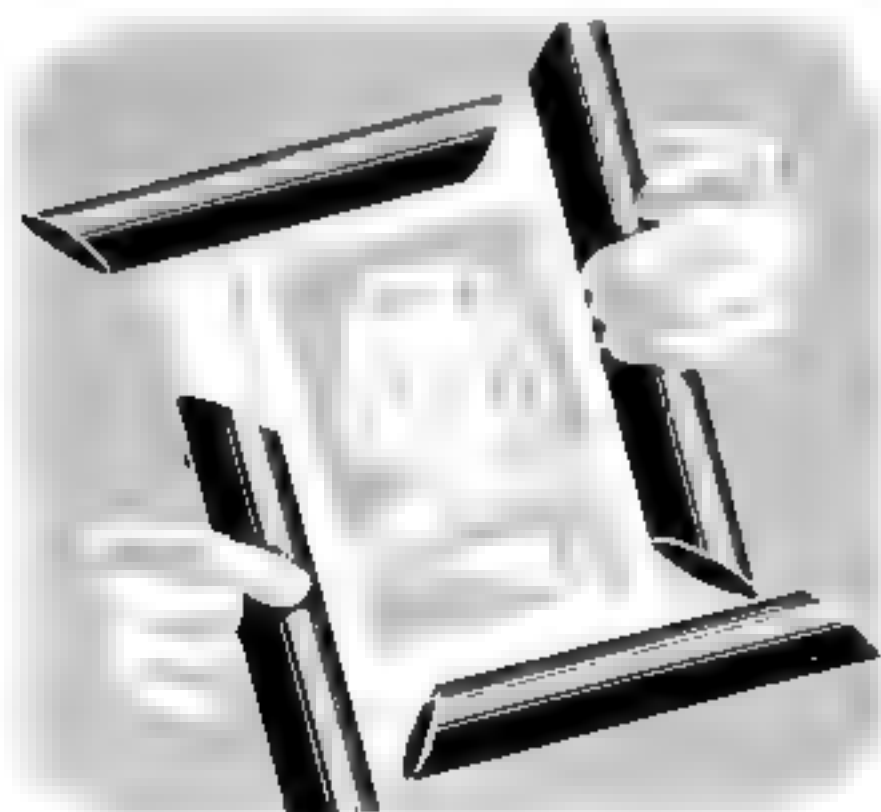


Hammer Can't Lose Its Head. A hammer head that won't fly off the handle is the object of an invention of Francis A. Lucia, of Brooklyn. A cover plate is held down tight over the head by an elongated, spread-legged staple whose ends are secured by countersunk nuts at the handle's sides.

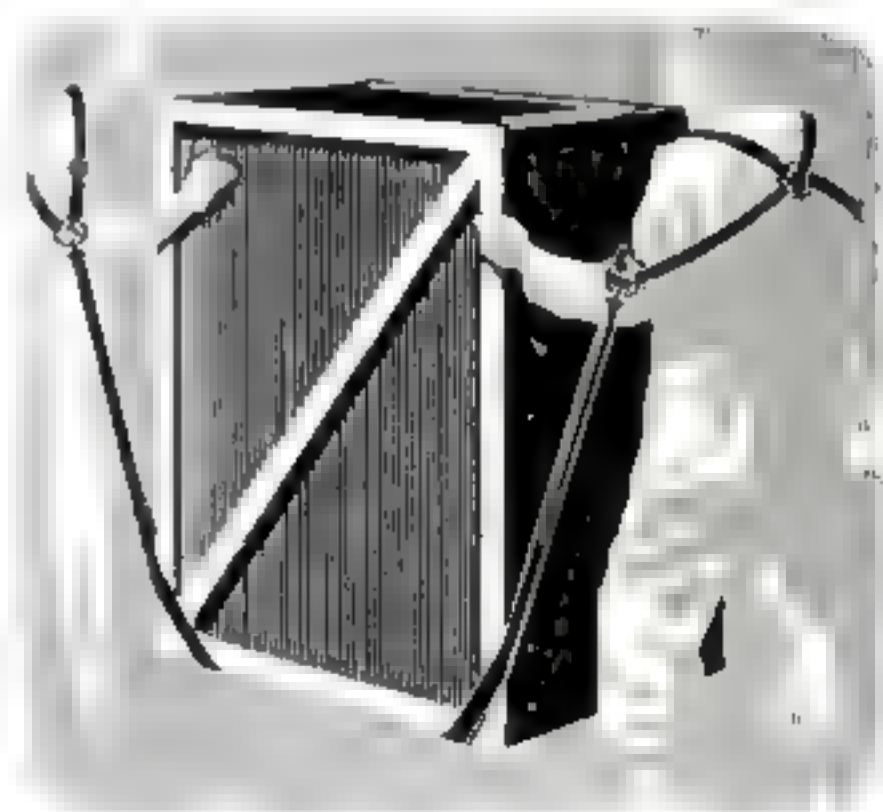


Traction Aid Clamps On. You could put on this tire traction device without having to move or jack up your car. Used instead of ordinary chains, it consists of two

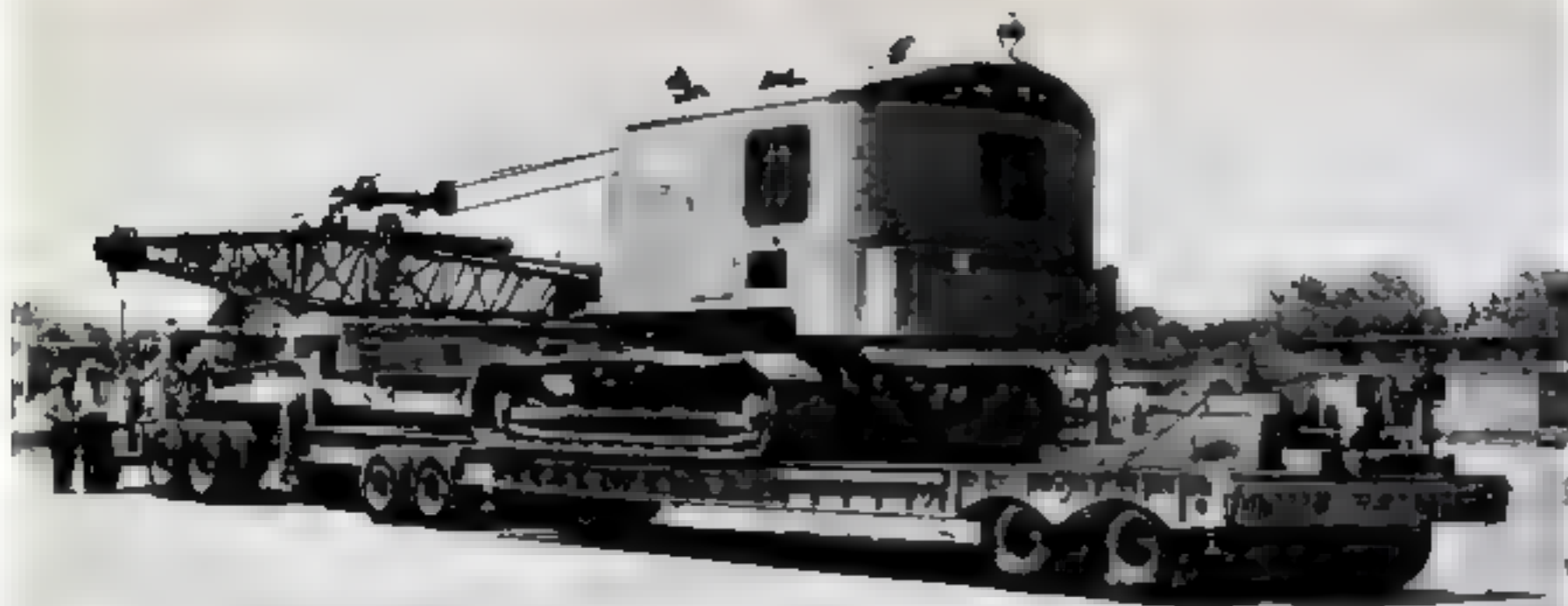
hooklike arms connected by a steel spring. They are clumped over the wheel, pulled together, and locked in place. It was invented by Herbert B. Harrop, of Middlebush, N. J.



Frame Is Slid in Place. Two sheets of glass, grooved on the edges, and four metal tubes, slit along one side and mitered at the ends, make this ingenious picture frame patented by Jean Le Boulengé, of Brussels, Belgium. The picture is inserted between the sheets and the tubes slipped on.



Harnesses Ease Lifting. To give you a lift as well as your load, William A. Theal, of Sullivan, Ind., has invented a pair of shoulder harnesses that allows two lifters to support heavy loads between them. Besides dividing the weight evenly, they eliminate tiresome stooping and leave hands free.



Big Stuff on the Move

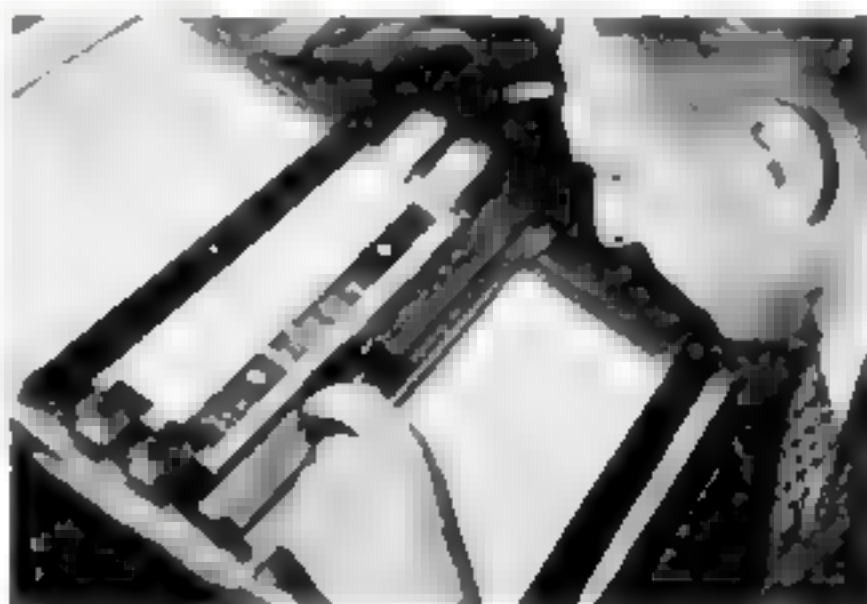
This massive, 100-ton-capacity road hog has an underpinning of 42 truck-tired wheels. It measures 75 feet from the tip of its truck to the tail of the trailer. In the photo above it is shown carrying an 80-ton

Diesel-powered drag line and shovel, with plenty of room to spare. Trailer and goose neck alone of this Fruehauf job weigh 43,400 pounds. Hauling of loads up to 100 tons is made possible by the great length of the trailer, which distributes the load between the front and rear groups of tires.



Japs Greet Midget Car

This startled MP has seen everything. Luckily there wasn't any traffic to snarl up when the Jap inventor drove his tiny, electric-powered car down a Tokyo street. Named the "Baby Star," it is about one-fifth the size of an ordinary automobile. A 400-watt motor, developing one-half horsepower, runs it for three hours at 25 miles an hour before the batteries need recharging. It can be converted to use gasoline. A homemade job, the wheels of this bantam auto were taken from dismantled airplanes. It is supposed to be a two-seater.



Mineral Facts on File

X-RAY photographs such as this scientist is examining, are the "fingerprints" of minerals, and like those of human beings, no two are alike. On file at Harvard's Berman Memorial Library are photographs of almost all of the possibly 2,000 known minerals, ready to identify unknown specimens. New minerals will be added as discovered.

Previously, difficult chemical tests were required to identify minerals. Now, a tiny sample is finely powdered and an X-ray photograph taken of its atomic structure. The resulting picture shows a series of concentric dark rings. By measuring the distances between the rings, and comparing them with a reference catalogue, the material can be identified in a matter of minutes instead of hours.



Telegram Prowl Car

PICKING messages out of the air instead of criminals off the streets, this new-type service car speeds up home delivery of telegrams. When a main Western Union office receives a telegram for you, it is ultra-short-waved to a "Telecar" assigned to your neighborhood. The driver picks up the facsimile message from the Telefax recorder located under the dashboard, as shown above, reads the address, and drives to your home to deliver it. Should you have a reply, he'll transmit it by radio from his car.



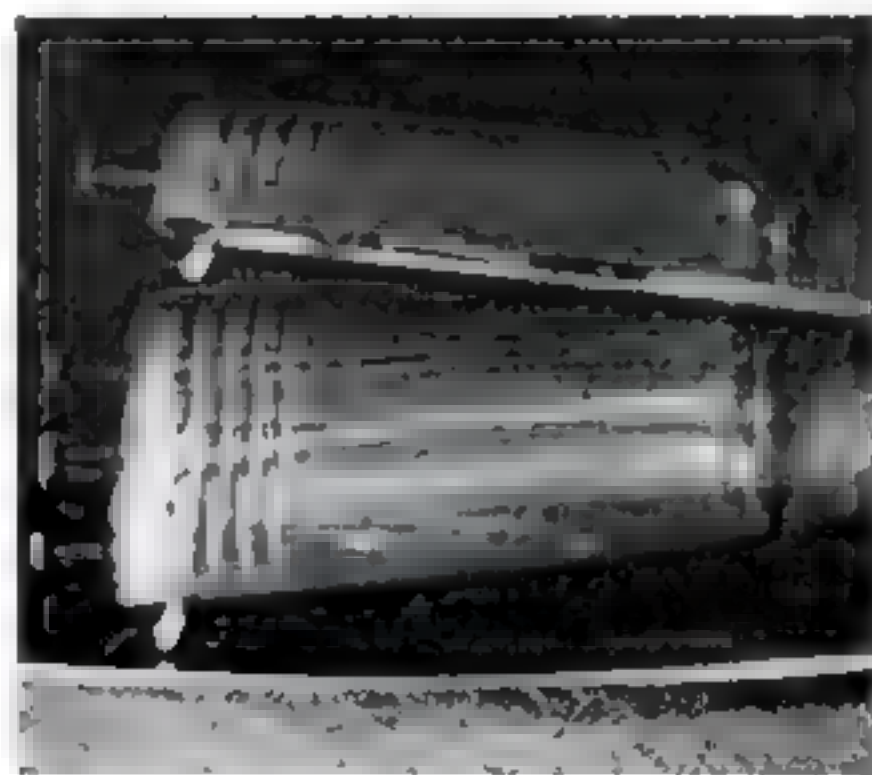
No More Wobbly Tables

How often have you suffered from table wobble? Cheer up, here is a gadget that automatically adjusts table-leg lengths to uneven floors. Inserted in leg ends, the Levelmatics shown above have a piston inside a cylinder filled with GE's famous bouncing putty (PS, Jan., '45, p. 97). The manufacturer, Blake Industries, of Detroit, explains that the magic putty acts as fluid does in a hydraulic mechanism.



Gun-Range Lead Mining

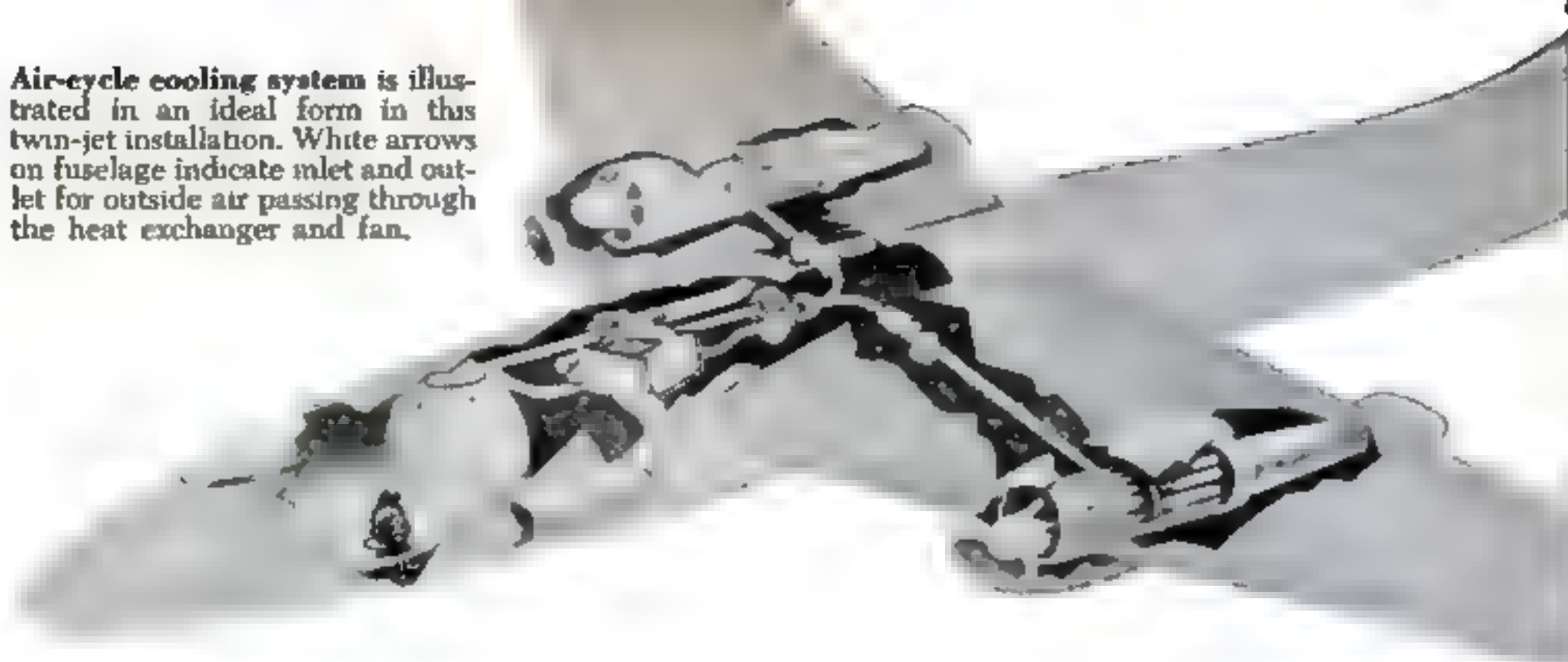
THIS novel dry-mining contraption recovered 13 tons of lead from the grounds of a Lewiston, Idaho, gun club in 20 days. It consists of two box sieves rocked by an old washing-machine gasoline motor. A coarse gravel screen in the top box sifts out large stones and weeds. The lead pellets, deflected by baffle plates, collect at one end of the lower sieve, the bottom of which is covered with window screening. In photo above, the clean lead is being dumped into an ammunition box for resale.



Needle that Bounces

THIS phonograph needle won't break records, or even crack them. If inadvertently dropped on your favorite platter, it simply bounces a few times, then settles down in the groove, as shown above. The shock absorber is a tiny nylon bumper connecting the duraluminum shank with the steel-spring needle tipped with precious metal. This new needle, claimed to be good for 5,000 plays, is made by the Duotone Company, New York.

Air-cycle cooling system is illustrated in an ideal form in this twin-jet installation. White arrows on fuselage indicate inlet and outlet for outside air passing through the heat exchanger and fan.

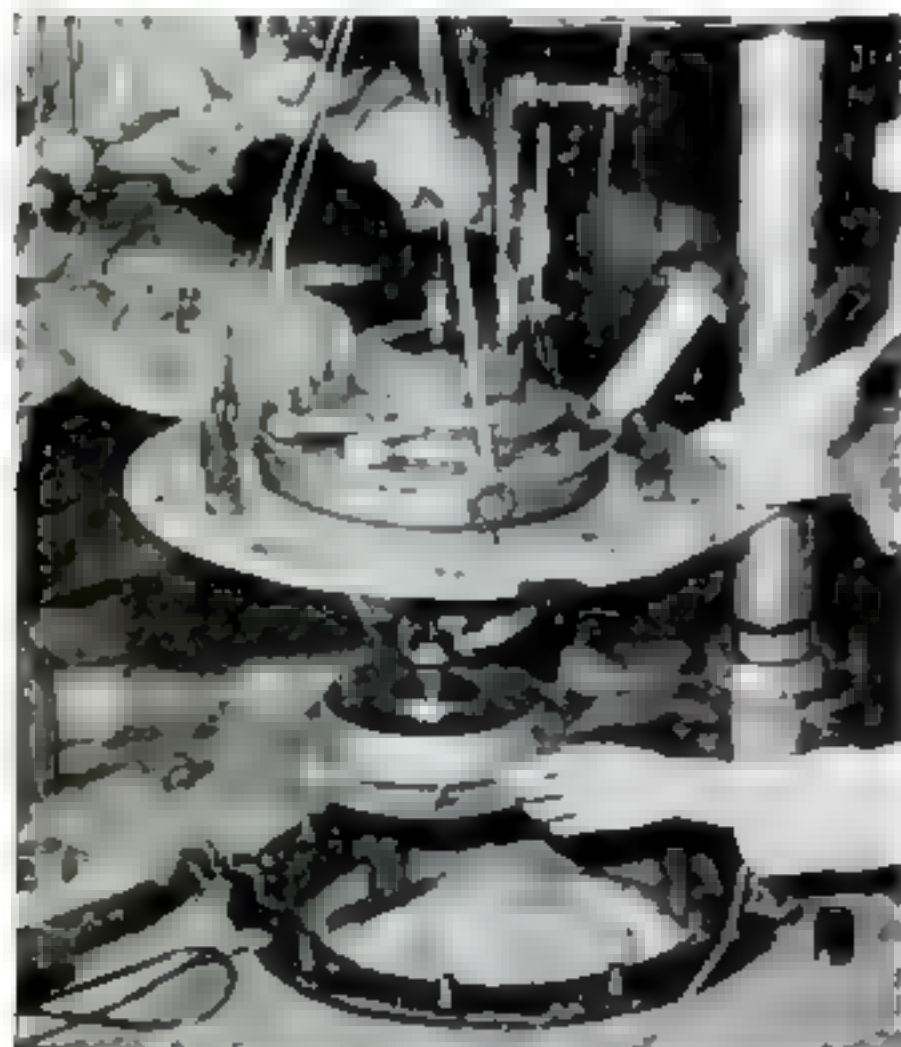


Cooling "Hot" Pilots

HUGE jet and rocket engines enable pilots to race the speed of sound, but a turbine no bigger than your fist keeps them alive while they do it. With a half-ounce rotor whirling more than 100,000 r.p.m., this midget takes air from the hottest part of a high-speed plane, turns it into a near-freezing blast, and keeps the cockpit from turning into an oven.

Without such super-refrigeration, even jet fighters' cockpits would be unbearable. In planes like the Douglas Skystreak and Skyrocket, temperatures would reach 180° F. at 650 m.p.h. At sonic speed (760 m.p.h. at sea level), the cockpit might hit the boiling point—210°. (For a report on how much heat a pilot can stand, see page 130.)

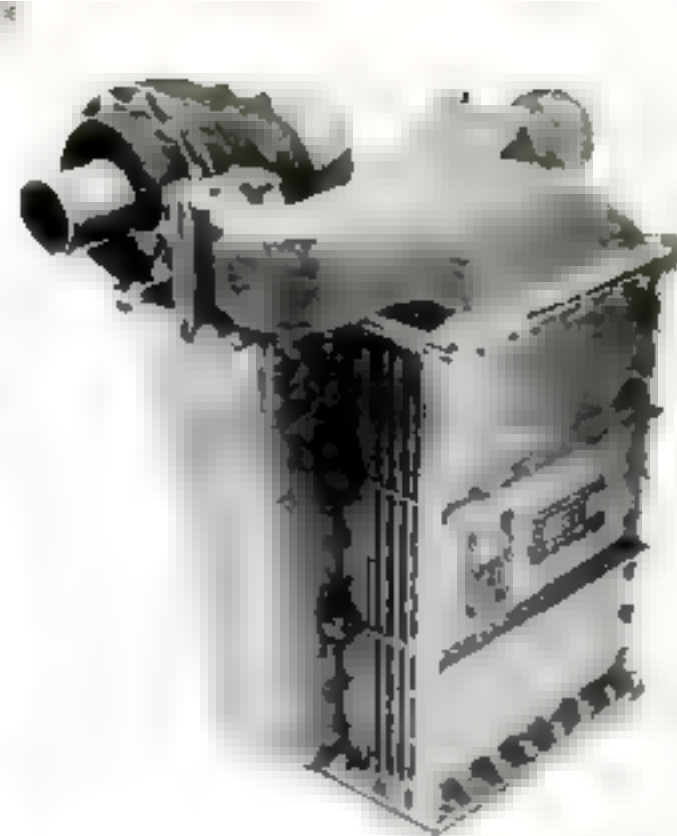
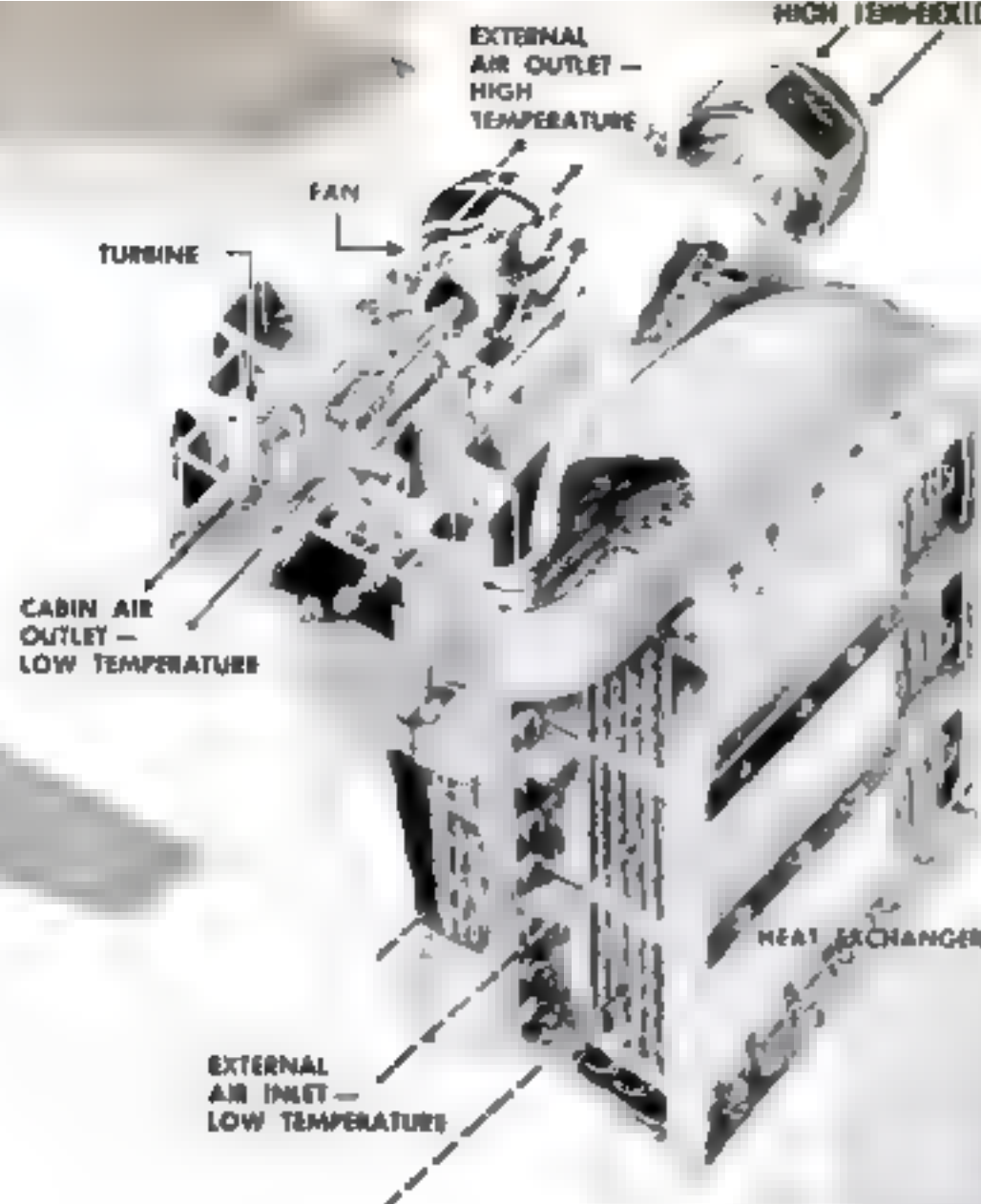
The miniature turbine, linked to an air-



Whirl tests in a sunken, wood-lined pit tear rotors apart to determine their bursting speed. Tiny rotor of the air-expansion turbine will



stand 140,000 r.p.m. Here a larger rotor is put in pit (above, left) and disintegrated (above, right). The wood lining is chewed to pieces.



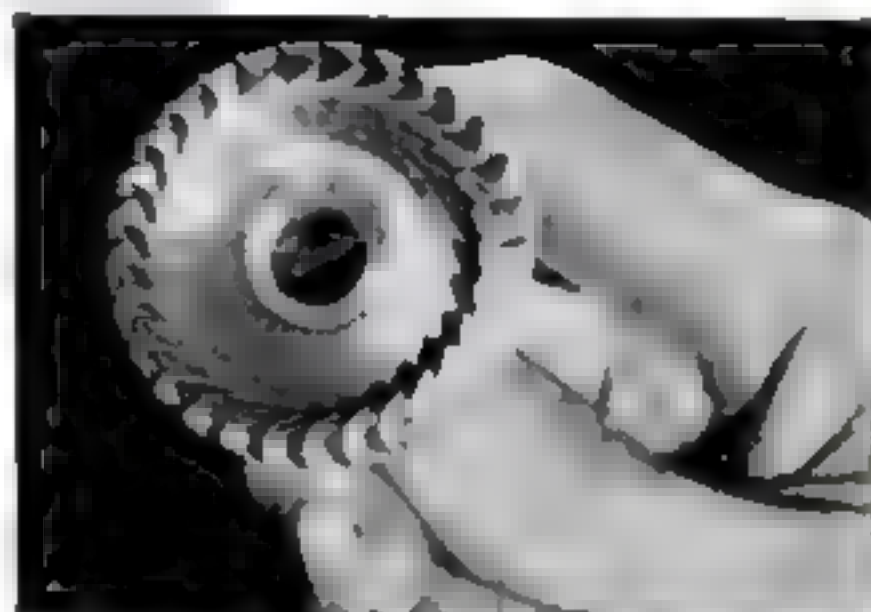
Turbine and heat exchanger make a compact package. Cutaway at left shows how outside air (broken arrows) and air from jet's compressor (solid arrows) cross trails in the exchanger. Turbine alone drops temperatures 135° ; total drop in both units is more than 450°

to-air heat exchanger, is the answer. Developed by the AirResearch Manufacturing Co. in a 16½-pound package, the refrigeration unit draws air from the compressor of a jet engine at 500° , spews it into the cockpit at 40° . This brings the cockpit temperature down to where you can live with it.

The hot compressed air first passes through hundreds of small tubes in the heat exchanger. A stream of air drawn from the outside of the plane flows around these tubes and carries away most of the heat of the pressurized air. Cooled but still compressed, this air then flows into the turbine chamber, where it expands with a rush and loses a lot more heat in the process.

Blasting through a ring of tiny nozzles at velocities up to 800 m.p.h., it drives the 1½-inch aluminum rotor, which in turn drives a fan at the other end of a connecting shaft. The fan performs double duty: it discharges the now-heated outside air, and in doing so imposes a load on the rotor that keeps it from ripping itself to bits.

The refrigerator assembly needs no power except that of the compressed air. Its only moving part is the rotor-fan element. And as a final advantage, it can be by-passed with the flip of a valve to let hot air flow directly from the compressor into the cabin—if a "hit" pilot ever gets cold. **END**



Vaness of tiny rotor, made of 24ST aluminum, are routed and finished with dental drills, running in an oil bath. Finished rotor is 1½ inches in diameter, weighs half an ounce



Working under seven pounds' pressure, an air-expansion turbine takes in air at 150° , spews it out at a frosty 15° . Under some conditions, pilots actually sit in this baby snowstorm.

I'd like to see them make...

Drawings by Lester Fagans

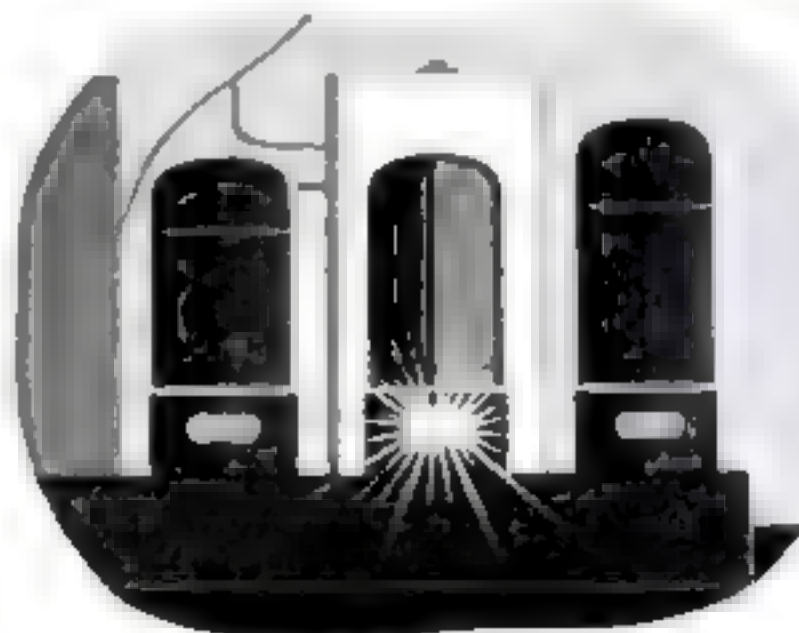
Everybody has his own pet idea of some gadget he would like to see in general use. What is YOURS? Popular Science will pay \$5.00 for each one published. Use government postcards only. Contributions cannot be acknowledged or returned.



Butter-Melting Toasters. How convenient it would be if a toaster was designed to mount flush with the table top. A butter melter and spreader brush would help too.—D. A. WALKER and G. H. LAIRD.



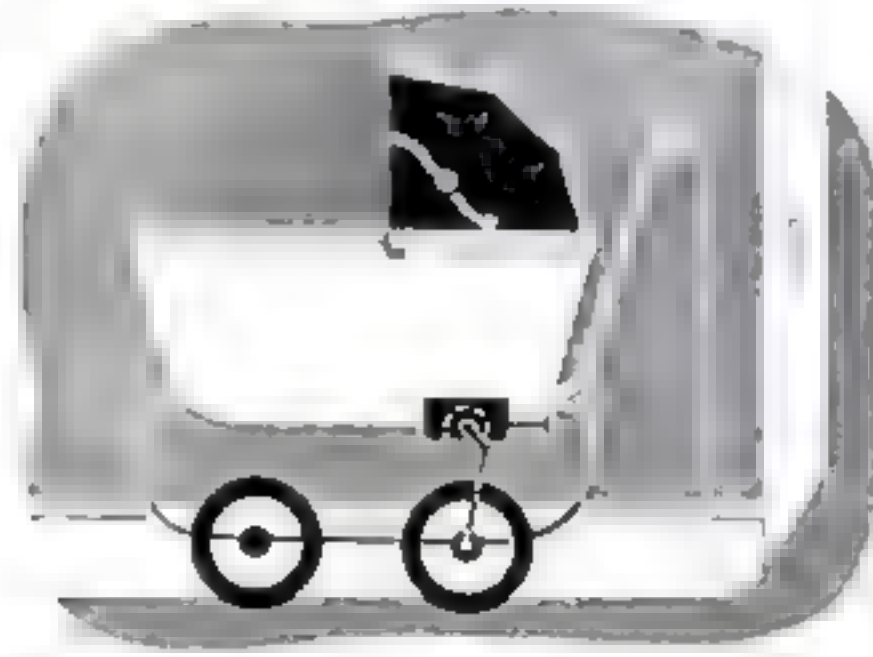
Paint Bombs. If paints of various colors were packaged in expendable compressed-gas cylinders like insecticide bombs, anyone could quickly do a neat spray job without fuss and bother.—TOM TENNY.



Tubes That Tell They're Bad. A new fuse has a built-in neon bulb that glows when the fuse is blown. The same idea could be applied to radio tubes, indicating a burned-out filament.—JIM RUFFNER.



Built-in Washboards. Metal tubs with the front side ribbed in washboard fashion would be a big help to the housewife. The washboard then would always be in position.—MRS. W. P. DUNAWAY.



A Carriage Rocker. My baby always begins to cry when the carriage stops. It would be nice to have a spring mechanism linked to the axle, rocking the baby while I shop.—MRS. BLANCHE GORMAN



These Safecrackers Can Get Away With It

And because they do, new protective alarms and detectors are making it tougher than ever for the hore mobs.

By Philip Gustafson

SOME of the world's most expert safecrackers are working overtime these spring nights under the appreciative and approving eye of police departments from New York to California. Whenever they crack a particularly tough safe the peace officers applaud, for these experts are helping battle the biggest crime wave in American history.

They are legal burglars. They operate on the side of the law, not against it. It is their job to outwit the underworld. That job has

become harder since shortly before the war ended. Where two burglars roamed the streets in war days, three are on the loose now.

The legal cracksmen are employees of Underwriters' Laboratories, Inc., in New York, Chicago, and San Francisco. They jimmy safes so that better safes can be built, but they do far more. They break into vaults, concrete strongboxes, and business buildings. They pry open windows, short-circuit alarm systems, and saw their way through heavy steel rods barring the way to deposits of valuables. They drill, hammer, rip, and blast.

The end-product of their work is to show up the weaknesses in burglar protection systems.

In their spare time they inspect burglar

alarms in the field and last year alone visited something like 2,000 mercantile establishments in all parts of the country.

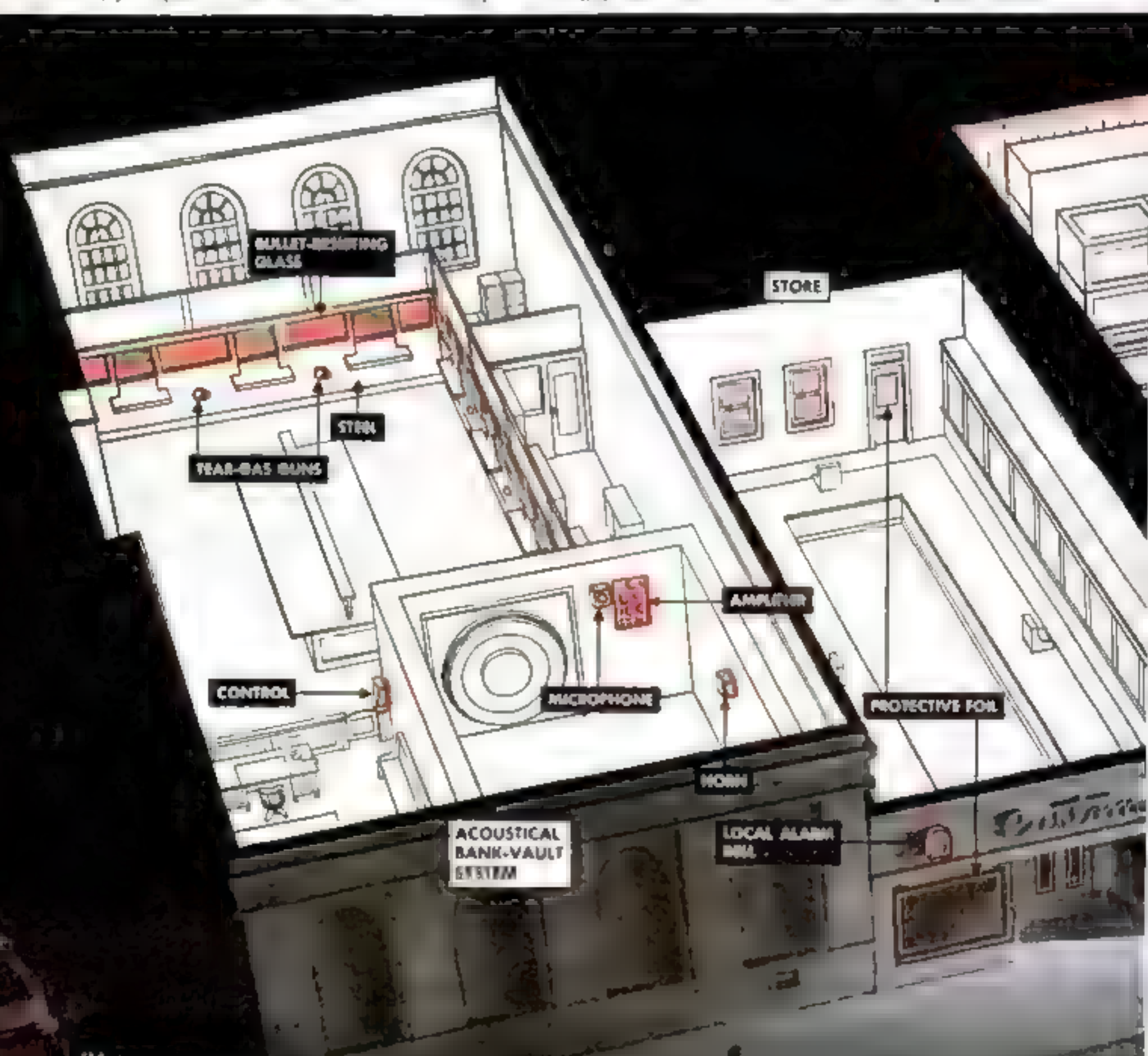
Edward N. Snowden, senior in the New York office of the Laboratories, has been cracking safes for 25 years. He and his associates even make it their business to have a pretty good idea what burglars will be thinking three and four years hence.

Burglar alarm equipment is Snowden's main interest. These alarms are of two classes. The first is the local alarm, with which nearly everyone is familiar, where a bell rings on the outside of the building to notify police or chance passersby that someone is trying to break and enter. The second type is the central-station system. Row on

row of fine copper wires cover or are embedded in walls at intervals of only a few inches. Doors and windows are bordered with strips of tinfoil. Wires and tinfoil are hooked up by trunk-line cables with alarms in the protection company's nearest central office—a place closely resembling a small-town telephone exchange. These systems are so sensitive that a current change as small as a thousandth of an ampere is enough to set them off, even though the circuit is made up of thousands of feet of copper wire not much larger than a horsehair.

Let a burglar hit a wire or tinfoil and all hell starts popping. Bells ring, lights flash and gauges go crazy in the central station. Police radio cruisers and carloads of guards

Below, you get an inside view of a variety of "bugs," tailored for four individual problems.



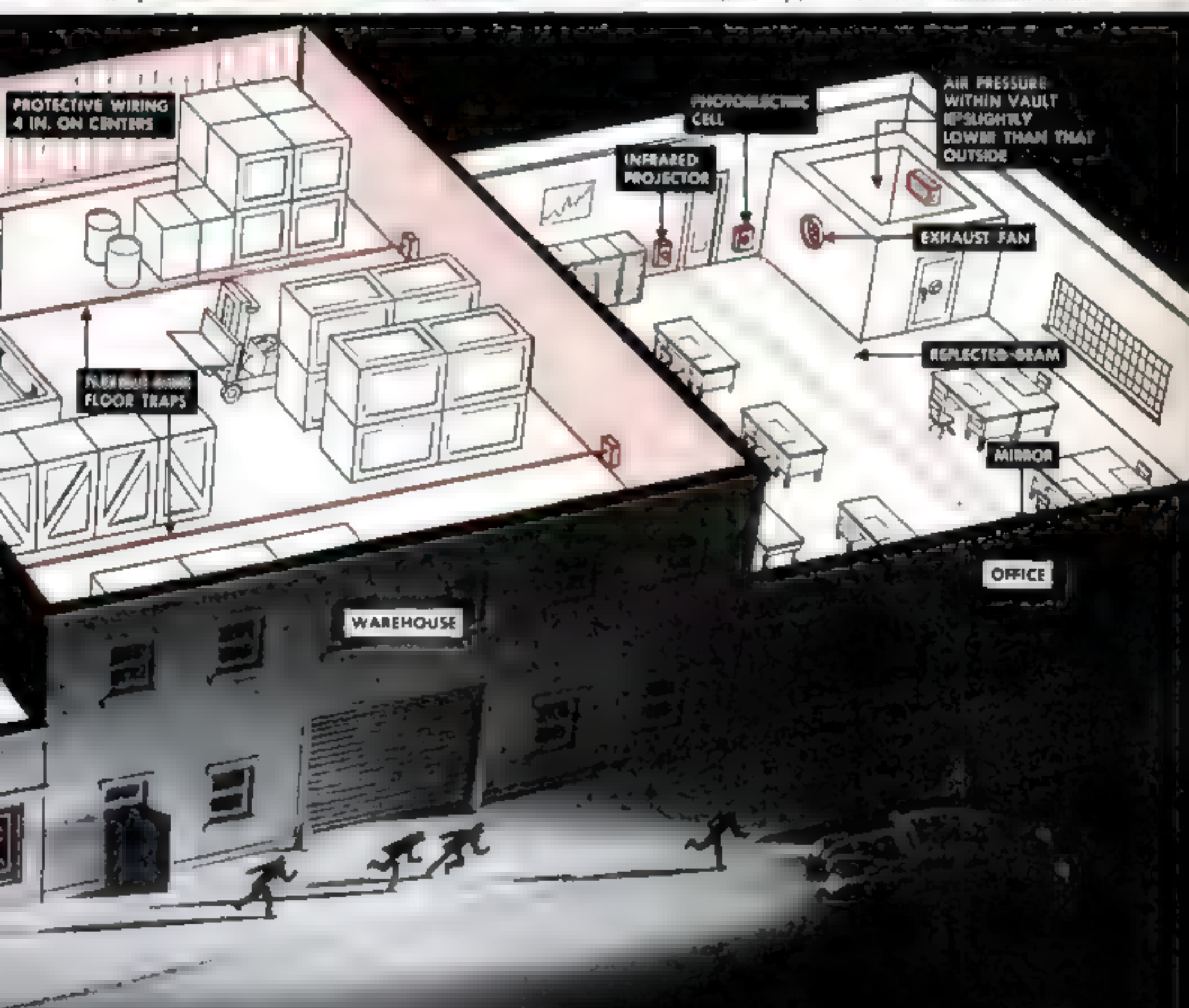
speed with sirens screaming to the scene of the break. If it's a Grade A alarm, the burglar had better fade in less than 10 minutes or he's a gone goose.

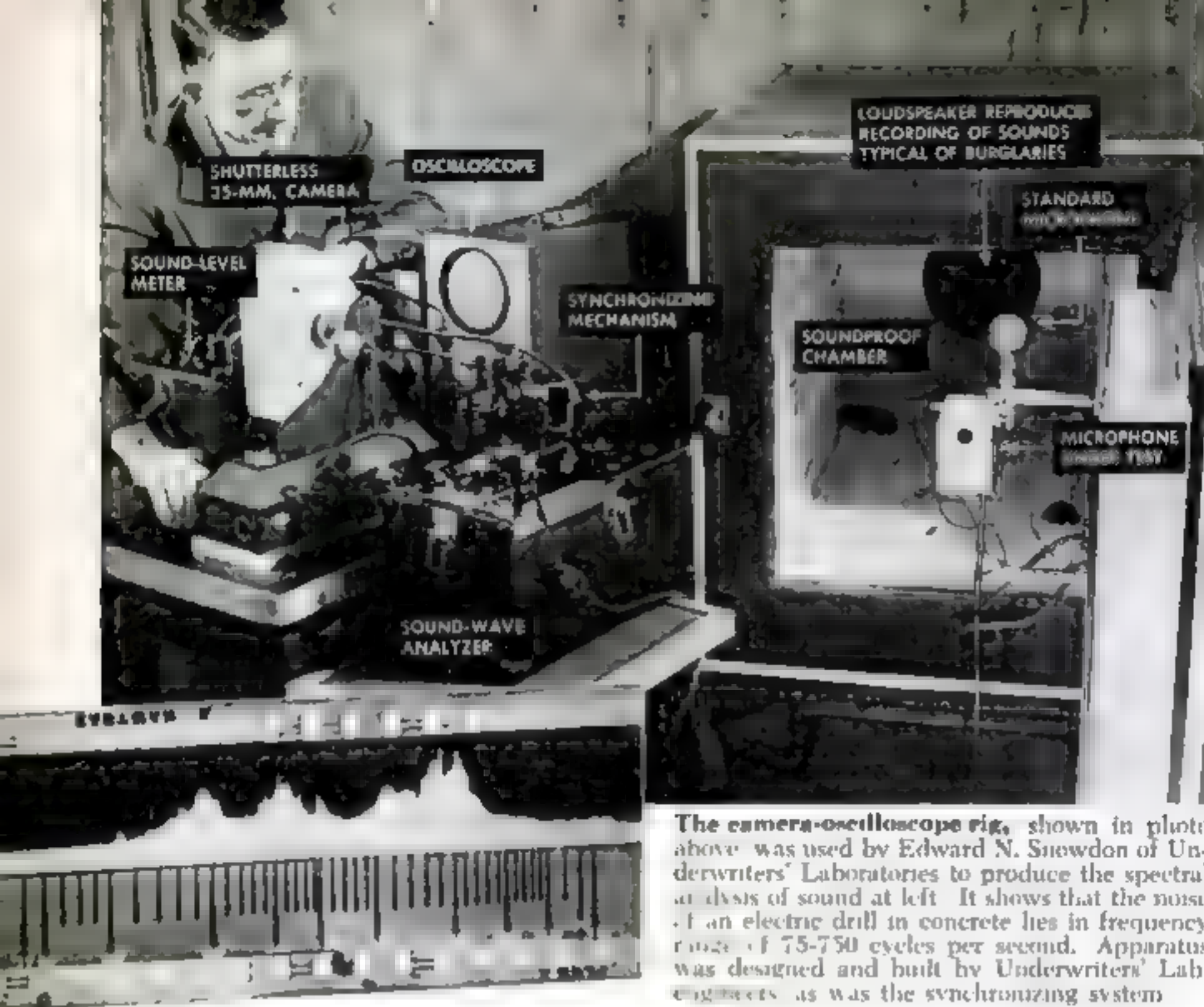
Burglars are always trying to sap through unguarded wall areas. Cost of construction and maintenance, as well as factors of appearance—in the case of show windows—have sometimes prevented the wiring of all floors, ceiling, and display space on commercial property, so a lot of the alarms still don't provide complete protection. A few professional burglars consider themselves smart enough to take advantage of this deficiency. These days, however, a great many such self-confident thieves are walking into the invisible beams of the new "electric eye"

alarms, which are also hooked up in circuit to ring in at the central station. Most of these alarms simply apply the principle of the photoelectric cell by which infrared light is focused in a beam two or three inches thick that can be thrown anywhere from 100 to 500 feet with maximum effect. The invisible infrared beam can be reflected by mirrors and interlaced between piles of merchandise in an ordinary warehouse like the strands of a "cat's cradle." Unable to see the light, the thief does not know what he has walked into until the guards from the nearest protective station swoop down on him with drawn guns.

"Since it is difficult and costly to guard all means of entry to a large business or storage

The protective devices are shown in red. Some slow the burglar up, while others tattle on him.





The camera-oscilloscope rig, shown in photo above, was used by Edward N. Snowden of Underwriters' Laboratories to produce the spectral analysis of sound at left. It shows that the noise of an electric drill in concrete lies in frequency range of 75-750 cycles per second. Apparatus was designed and built by Underwriters' Lab. engineers, as was the synchronizing system.

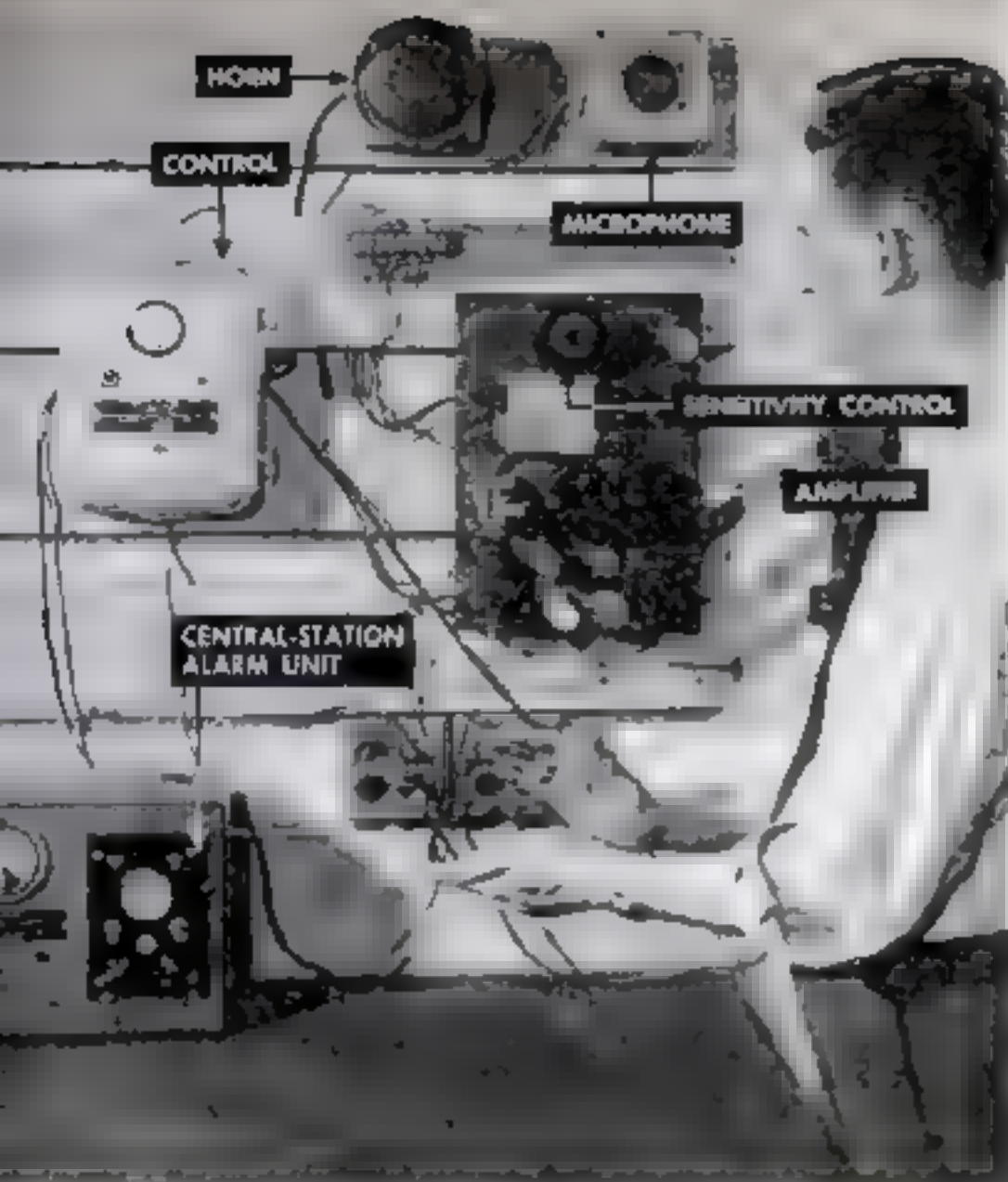
building," Snowden explained to me, "there is a growing tendency to concentrate protection on the valuables that the burglars might attempt to steal. Here, some of the new electronic principles are being widely applied."

One of the most interesting is the new "telapproach" mechanism, which for all practical purposes throws an electrical field around the safe or other piece of property to be protected. Known to the trade as the "body capacity system," it makes use of an "antenna" like the old-fashioned radio. Then any interference, such as a man walking near the safe, destroys the equilibrium of its balanced oscillating system, and the "telapproach" turns in a "squawk" at the central station.

Also in common use today is a "burglar alarm with ears." Vaults are equipped with microphones so sensitive that an alarm can be set off literally at the drop of a pin. Ordinarily, however, they are not set to so fine a pitch, but they will go off readily at a clap

of the hands. These microphone alarms are really very choosy mechanisms. They will turn up their noses, for instance, at the rush of a train, but will set up an awful howl in the central station if anyone turns on an acetylene torch or does any gentle hammering in their neighborhood. Close kin to these microphone alarms are the highly developed vibration detectors, which actuate an alarm at any attempt to drill or burn through a vault wall or door. These too are very particular little gadgets that can be set to ignore traffic rumbles.

Snowden and his assistants test these microphonic mechanisms with phonograph records. On occasion, these engineers are called upon to make tests on permanent structures in the field. With their recording and transcribing equipment, they in effect bring the mountain to Mahomet. Painstaking recordings are made during these realistic burglary tests, with all pertinent data accurately noted. These faithful recordings are then played back in the laboratory where



An acoustical bank-vault system is tested for sensitivity. Even a handclap will activate the alarm, but the sensitivity can be adjusted so that it isn't set off by ordinary noises near the installation. Horn, mike, and amplifier would be inside vault; control mechanism would be outside vault and connected to central-station alarm by regular telephone.

the process of analysis is carried out. It saves getting out the drills and torches every time a new control mechanism arrives.

One of the most interesting of the new alarms utilizes a feeble vacuum that is produced within the vault by a small fan set in the wall. Ingenious and extremely sensitive control apparatus instantly detects even such a slight change of air pressure as might be produced by making a small hand hole in any of the vault walls.

Tear gas is also used to protect vaults and safes against burglars. It is discharged automatically in the event of an attack on a door or combination by actuating mechanisms that are usually mechanical and involve no electrical controls at all.

The latest of scientific devices—many of them using new detection methods developed during the war—have already been applied to new burglar alarm circuits. These systems employ infrared, supersonic, ultrasonic, and microwave propagation. The detection devices operate by reflection, re-

fraction, interception, and sometimes by frequency modulation. These modern burglar alarm systems are designed to radiate imperceptible energy in one form or another and the detection units respond to any interruption in reception.

When it comes to applying new inventions, the criminals have always been quick to show the forces of law and order that they have no monopoly on science. Postwar scientific crime confronted New York police early in 1946 when they arrested four youths—none of them old enough to vote—who were using walkie-talkie-equipped lookouts to warn of approaching police. The four boys were already responsible for 75 burglaries and 42 robberies, police calculated, netting at least \$10,000 and possibly as much as \$50,000. The 20-year-old brains of the gang was a former radio specialist in the Navy who made the walkie-talkie sets used in the robberies.

Burglar Alarm Best Insurance

What the postwar world may breed in the way of a supercriminal still remains to be seen. But the best protection for the property owner, crime prevention authorities agree, is a good electric burglar alarm that brings organized response on the run. However, due to the general apathy of property owners, as well as the cost of installation and maintenance, these alarms are used by less than 50,000 subscribers the country over. Local alarms, with the bell outside the building, total perhaps twice this number. Thus, all but a small fraction of the nation's businessmen pin their faith on locks and bars.

Though the two-way radio car is the deadliest enemy burglars ever had, police ask property owners not to leave everything to the cops.

Effectiveness of central-station alarms is shown by the latest annual figures of the American District Telegraph Company, largest alarm firm, with some 20,000 central-station installations in cities about the country. ADT reports 1,748 attempts in 1946; burglars got in 920 times and 589 were caught. But when all the returns were in, the company claimed property losses of less than a hundredth of one percent of insurable value!

"The history of locks, safes, and vaults," says Snowden, "has been just one chapter after another of a dog-eat-dog contest between the maker of locks and the breaker; between locksmith and burglar. It's been

going on since men first began to accumulate property. And the game is still going on hot and heavy."

Each war brings its own crime wave and each crime wave produces its own particular brand of criminal, who runs wild for a while until the law chases him to cover. Police say there are plenty of good "pete men," or safe crackers, at work about the country, and they dread having a "mob" hit town because it sometimes takes two or three years to root them out. Captain Ray Maguire, Chief of New York's Safe and Loft Squad, who has been chasing this particular brand of burglar for something like 21 years, still has painful memories of a pair of expert operators who collected several hundred thousand dollars before they were put away in 1946 after a chase that lasted a year and a half.

It was late in the fall of 1944 that banks, loan associations, and business houses first began to be looted with sickening regularity all around the New York metropolitan area by what the newspapers called "phantom burglars." They just seemed to walk right in and out of the most strongly made business buildings without leaving the mark of a jimmy, a broken glass, or even a speck of dust to show how they did it. In job after job, the "phantoms" showed they knew every standard way of opening a safe by force—burn, rip, blow, and punch.

Home Workshop of Crime

Finally, the case broke when a pair of detectives from the Safe and Loft Squad spotted two men sizing up a Manhattan bank. After two weeks of intensive shadowing, Captain Maguire and his men swooped down on five-foot-five Stanley Patrek and his husky six-foot pal, Joseph Stepka, still in their late twenties, in the very act of burglarizing the Yonkers Savings and Loan Association of \$15,000. The two proved to have one of the best-equipped criminal workshops ever uncovered. They were master machinists, metallurgists, and locksmiths. They had even taken jobs in war plants to brush up on the handling of the tricky acetylene torch. Their mysterious entries into banks were usually arranged days in advance, when during business hours they'd slyly remove the cylinder, or business part, of the lock and keep it just long enough to make a key. Then some night when they needed money, they'd call back and open the safe. These two were, without a doubt,

the cleverest pair of burglars he has ever encountered, Captain Maguire declares.

"However, the average business building is a cinch for any good burglar," he says. "Most of the time burglars jimmy the windows or doors and go right in. Sometimes they conceal themselves on the premises at the close of business hours, take what they want during the night, and then just walk out the door. Some 'aerial' burglars swing by ropes from the roof and break in unprotected windows. And then again you get what we call a 'bore mob' that literally bores through walls and floors over the weekend and loots whole business buildings of money, furs, jewels, or whatever seems worth-while. Unless it's guarded by watchmen, a business building is safe only if it's been 'bugged,' as the burglars say, which means wired up for a good burglar alarm."

Buffet Burglary

The classic example of "bore-and-smash" operation in recent years was the Portage Park Vault Company job in Chicago. Here a mob of master cracksmen looted 500 safety deposit boxes of jewels, heirlooms, and money galore—much of it believed to be cash belonging to big-time Chicago gamblers—with losses said to run into millions. The burglars came in Saturday afternoon and worked right through the weekend to early Monday morning, refreshing themselves at intervals with milk, soda, beer, and sandwiches. They needed time—they had to burn their way through one large steel door with torches and smash through 18 inches of reinforced concrete.

Snowdon "covered" the Portage Park job, as he does in a few major cases, just to see whether the mob had picked up anything new that his office didn't know about. The Portage Park vault, which had 10-inch steel doors set in its 18-inch reinforced concrete walls, was much heavier than the average bank-vault installation, so he reported that the most modern bank vault is vulnerable to attack and that physical construction should be backed up by proper burglar-alarm equipment. END

Gnawing Is Rat's Life Insurance

If a rat didn't gnaw constantly, its gnawing mechanism—a set of sharp incisors curving back toward its throat—would grow back into the throat. As a result, the animal would strangle in as little as a year's time.



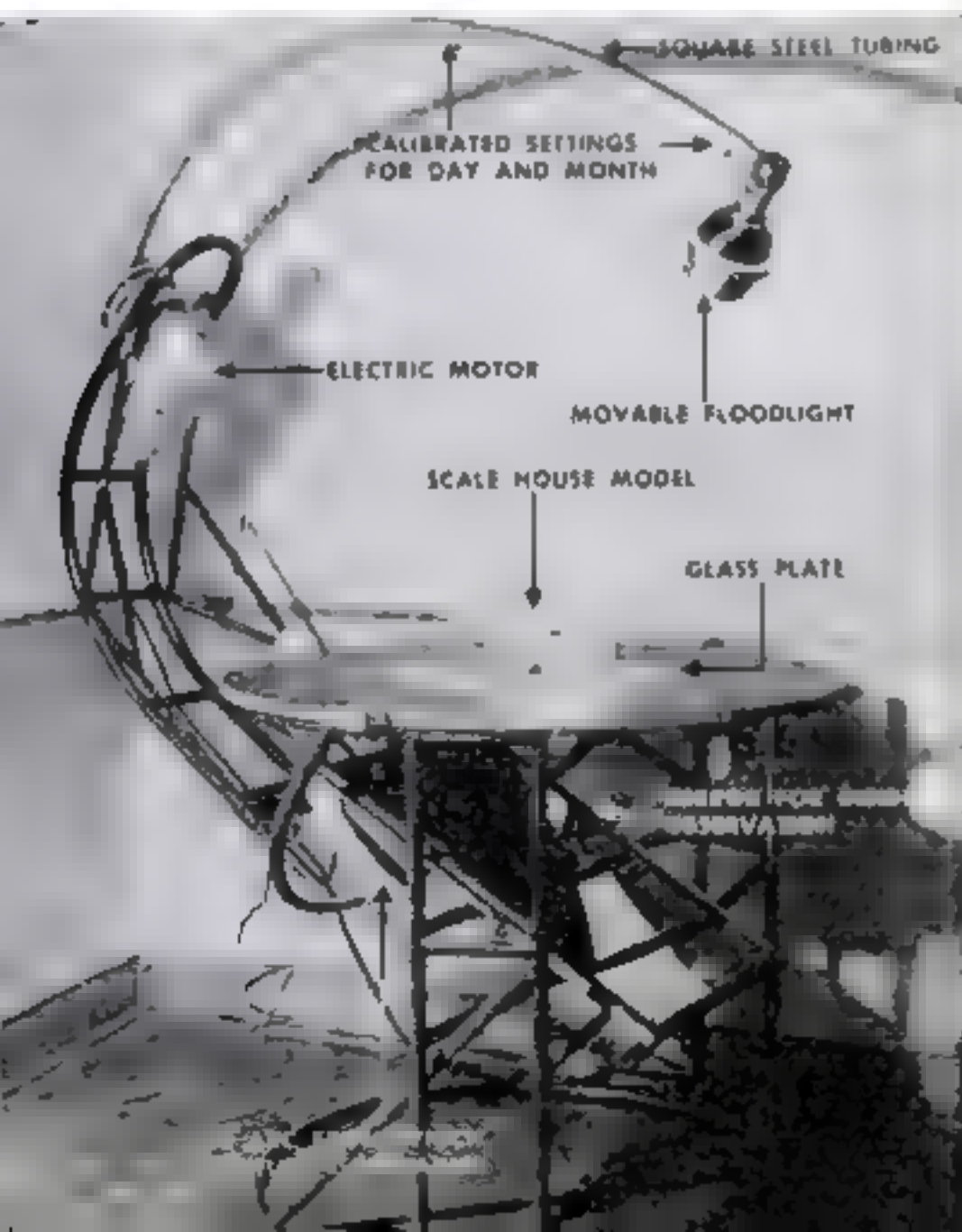
Barrow Climbs a Hill

THIS may look like an oversized wheelbarrow—but did you ever see a wheelbarrow climb a hill under its own power? This three-wheeled, power-driven dump truck can take a 1,000-pound wet or dry load right up a 20-percent grade. Called the Prime Mover, the 400-lb. machine, made by Bell Aircraft, can turn in its own length. Its three-hp., air-cooled engine runs eight hours on three gallons of fuel. The 10-cubic-foot self-dumping bucket can be enlarged with sideboards to hold up to 18 cubic feet. For larger loads, a platform replaces the bucket. A snowplow can be attached.



Quick Window Washer

DON'T you wish you could clean the windows in your home as easily and quickly as this mobile window washer can make train windows sparkle and shine? Designed by W. H. Gould, superintendent of the Union Pacific's car department at Pocatello, Idaho, it can clean all the windows of a 12-car streamliner in eight minutes flat. The job is done by a revolving brush mounted on a small power truck. As the truck speeds alongside a waiting train, water is sprayed on the windows and the spinning brush scrubs them clean. Thirty gallons of water are used in a 12-car cleaning operation.



In the Path of the Sun

SOMETHING new under the sun is this novel heliodon that shows the where and when of sunlight as it would affect a building at any time of the day, month, and year—and at any given latitude.

The arc-suspended floodlight shown in the picture at left doubles for the sun. Telescoping tubing from which it is suspended can be adjusted for the time of day and month desired. Latitude is obtained by setting the rod's base along a 90° arc beneath the table. An electric motor swings the floodlight over the house in 30 seconds, duplicating the sun's path from sunrise to sunset. An underneath mirror allows observation of interior sunlight effects through the glass floor. Invented by Prof. George M. Beal, of the University of Kansas, the new heliodon shows architects how to use natural lighting to best advantage, while screening out excessive sunlight.



"Locomotive" poised for a 1,000-m.p.h. desert speed run. Note airfoil mounted for test.

Rocket "Locomotive" ***Hits 1,000 M.P.H.***

USING the 50,000 lb. of thrust developed by five big rockets, experimenters have sent a "locomotive" hurtling 1,019 m.p.h. down 2,000 feet of standard-gauge railroad track.

They had a reason. They wanted to learn if it is possible to reach speeds beyond the 760-m.p.h. of sound at sea level with an earth-bound vehicle that could be controlled. This would give them a new way to test airplane shapes designed to zip through the transonic region.

The answer is that it is possible to achieve the speed, but hard to control the vehicle.

Disclosure of the experiment at California's Muroc Air Base was made by Northrop Aircraft, Inc., with the consent of the U. S. Air Force. A model airfoil is suspended on the front end of a needle-nosed rod and sent screaming down the track. It's the reverse of the wind-tunnel system, in which the air is rammed past a stationary model.

The "locomotive" is really a 15-foot, aluminum-alloy sled—a modified jet-bomb launching device. It slides on "slippers" made of magnesium, with stainless-steel inserts for bearing surfaces. Flanges keep it

on the track. The thrust of the five massive Monsanto, T10-E1, solid-fuel rockets lasts 1.8 seconds. The track method, incidentally, has already been used to launch supersonic rockets into the air. (PS, Apr. '47, p. 118).

For test runs, small wing and fuselage shapes are mounted on the rod, or boom. Records are made with high-speed movies and electrical devices. Every 50 feet a small switch, tripped by the speeding carriage, transmits an electric timing signal. The trouble comes when the experimenters try to stop the monster. Up to now they haven't been able to. At the end of the track it tumbles across the desert sands. That ruins it. They tried braking it by dropping a spout into a trough toward the end of the run and making it scoop up water, which was deflected upward and out the top of the sled. But it didn't help much.

Northrop hasn't given up trying to perfect the method, however. The company believes that if only the apparatus can make its 1,000-odd-m.p.h. run on a two-mile track—and be stopped safely in that distance—it will tell them much about design performance at supersonic speeds.



Rooftop Radar Rolls Up

How to set a 5,200-lb. radar unit on top of a 200-foot high hangar did not stump engineers at the Navy's Moffett Field, Calif. They placed the radar on a bobsledlike dolly fitted with big rollers. Then a line looped over the hangar from a winch on the other side hauled the dolly up the wall.



Twin Light Beams Measure Heat

A beam of light now takes the temperature of rocket flames so hot they would destroy ordinary thermometers. The new light-beam instrument, called an absorption-emission pyrometer, is expected to aid research on rockets and rocket fuels. It makes a continuous record of temperature changes in different parts of the exhaust as the rocket motor starts up on the test stand.

The pyrometer measures flame temperature by the amount of light absorbed and emitted by the flames. Light from a lamp

is split into a pair of beams; one beam passes through the flame, and the other does not. An arrangement of mirrors and disk shutters makes the two beams fall alternately on one photoelectric cell. When the brightness of the lamp is varied until the photoelectric cell receives the same amount of light from both beams, the temperature of the flame can be calculated from the lamp brightness. The new pyrometer was developed by Dr. Donald H. Jacobs, of North American Aviation, Inc.

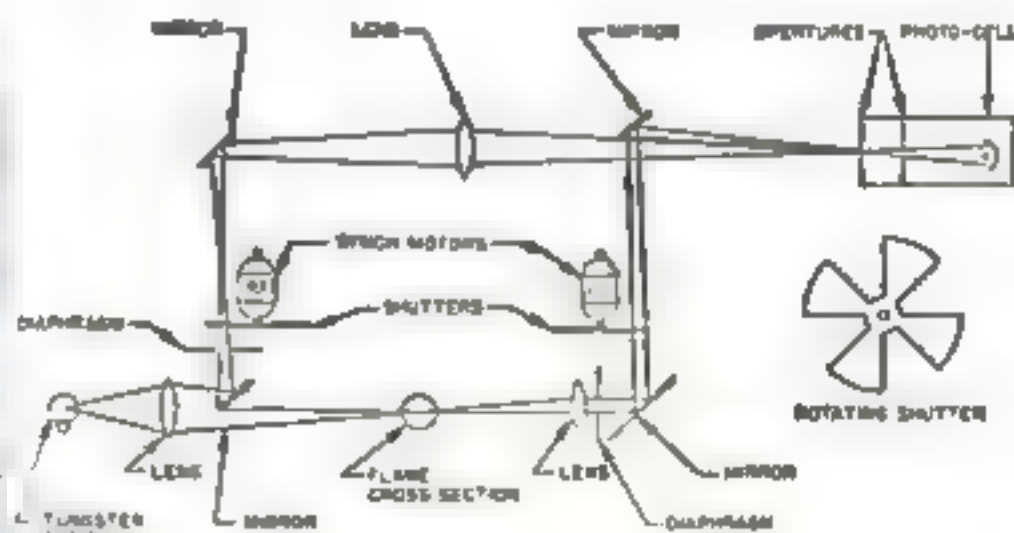


Diagram above gives layout of new pyrometer shown at left. Light from lamp (bottom, left) is split into two beams by lower left mirror, which sends one beam up and around flame as other beam goes through flame. Shutters make beams strike photocell alternately.

What's New in Aviation



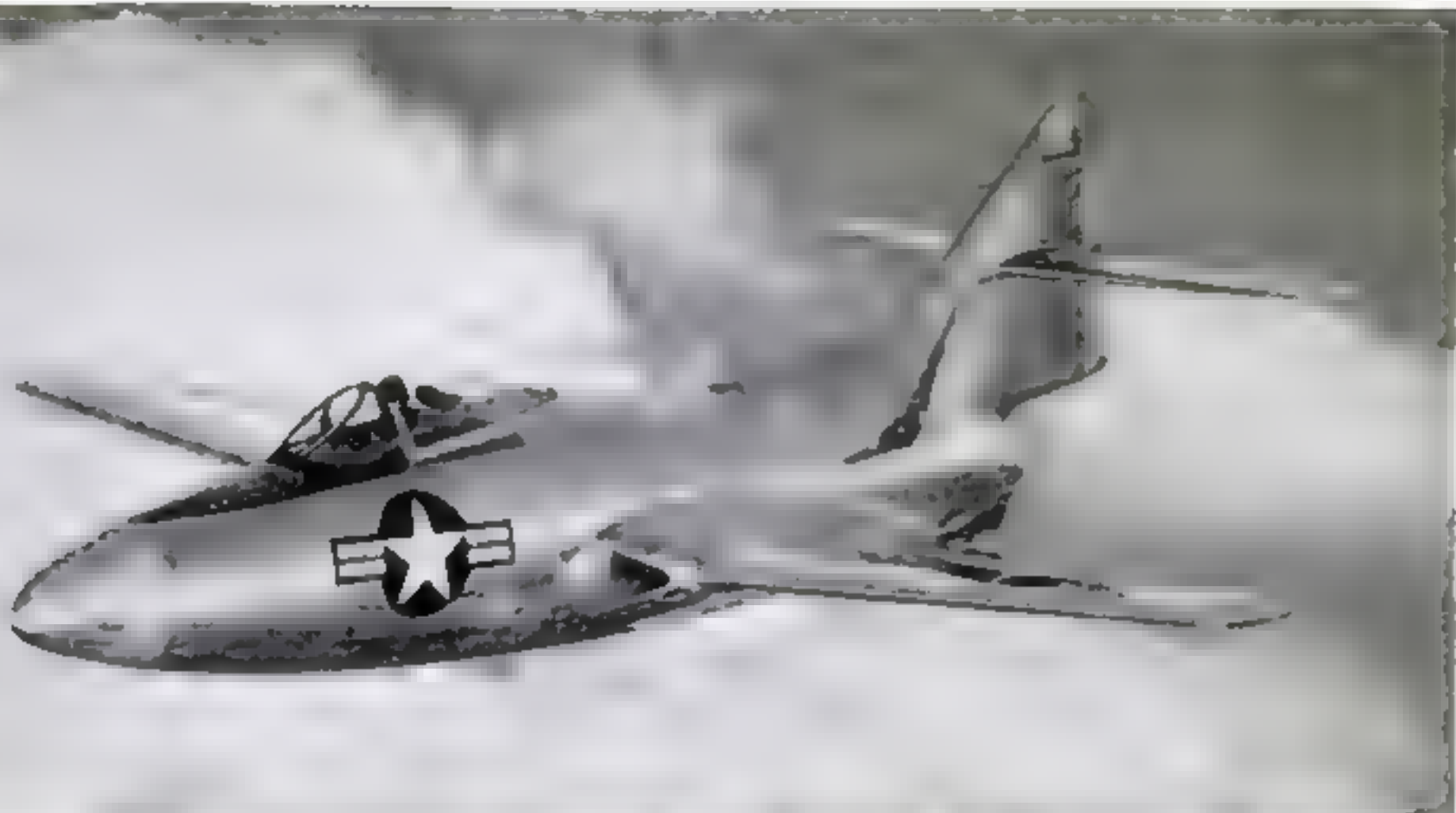
Nazi Glider Is All Wing. Captured by the U. S. Army, this Horten Model VI glider has been repaired and reassembled in California at the Northrop Aeronautical Institute for aerodynamic studies. Its elongated wing spans 78 feet, but the cockpit is so small that the pilot has to lie prone to fly the 750-pound craft.



Navy Planes Don Coveralls. Form-fitting zipper bags are the Navy's newest solution to the problem of preserving its planes for short periods. The glass-fiber coverings can be put on in a quarter of the time required for older methods of protection. Drying agents inside the bags protect planes for three months.

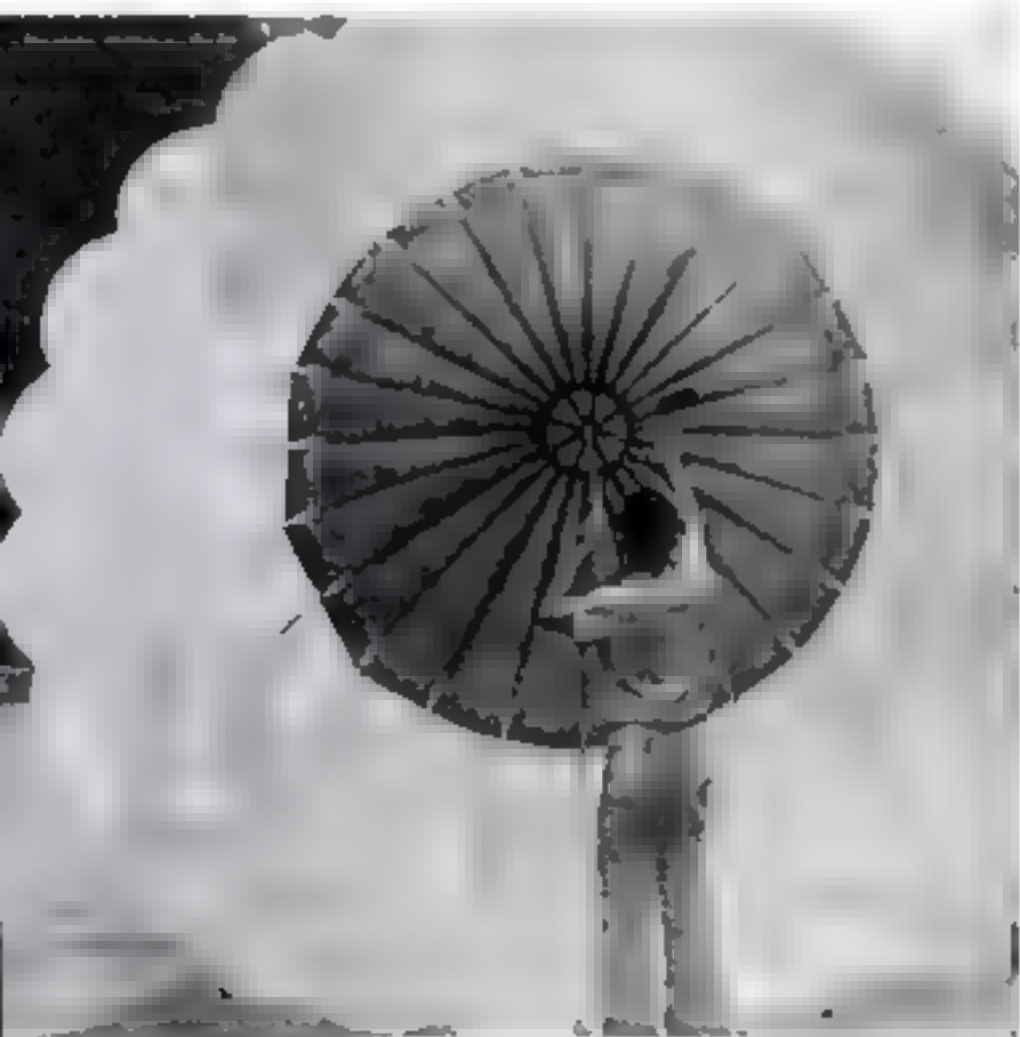


Aerobatic Autopilot. A new Westinghouse automatic pilot weighs only 35 pounds, but is said to be the most sensitive ever developed. Unlike other autopilots, it maintains control even in high-speed loops or rolls. The illustration above shows an engineer holding the control knob of the camera-sized device.



Jet for Carriers. Grumman's XF9F-2 Panther is the latest addition to the U. S. Navy's seagoing air force. Especially designed for short-runway work, the fighter

is rated in the 600-m.p.h. class. First model has a Rolls-Royce Nene jet, built by Pratt & Whitney. Later ones will have Allison's, interchangeable with the Nenes.

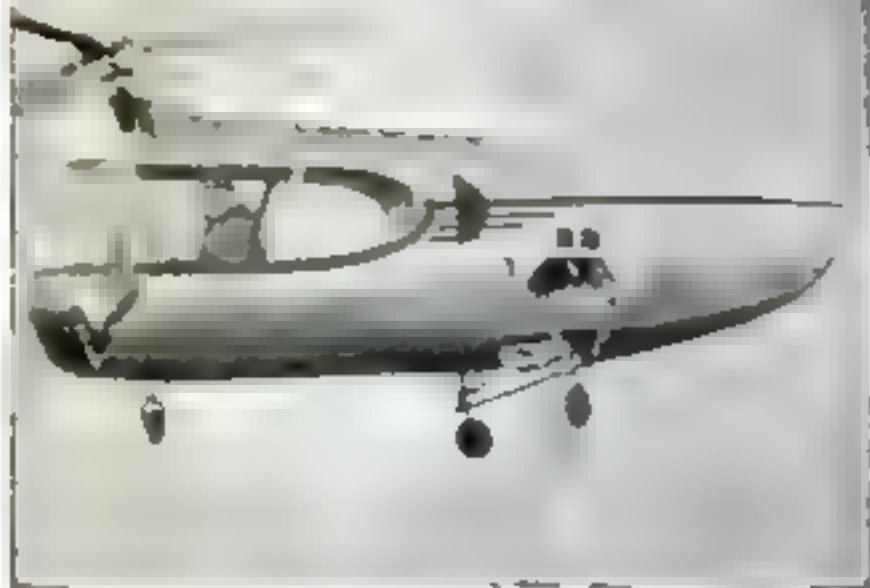


'Chute's Cap Offsets Speed. The center panel of this experimental Navy parachute is held in place by elastic cords. When the 'chute opens at high speed—it has been tested at nearly 500 m.p.h.—the cords stretch and air spills out, lessening the shock. As the 'chute slows down, the elastic pulls the cap back into place.



Tailless Jet Goes Aloft. Britain's Armstrong-Whitworth 52, a twin-jet, experimental craft, has made its first flights. A novel feature of the plane is a "boundary-layer suction" system—a spanwise slot in the ultrasmooth, 90-foot wing. It sucks in air passing over the wing, and helps control the flow and cut drag.

What's New in Aviation



Cutting 'Copter Costs. Economy is a major aim of the JOV-3 two-seater, built by the Helicopter Engineering Research Corp., of Philadelphia. It weighs only 800 pounds empty, and a four-cylinder, 100-hp. engine drives its two 18½-foot rotors. Its cruising speed is 73 m p.h.



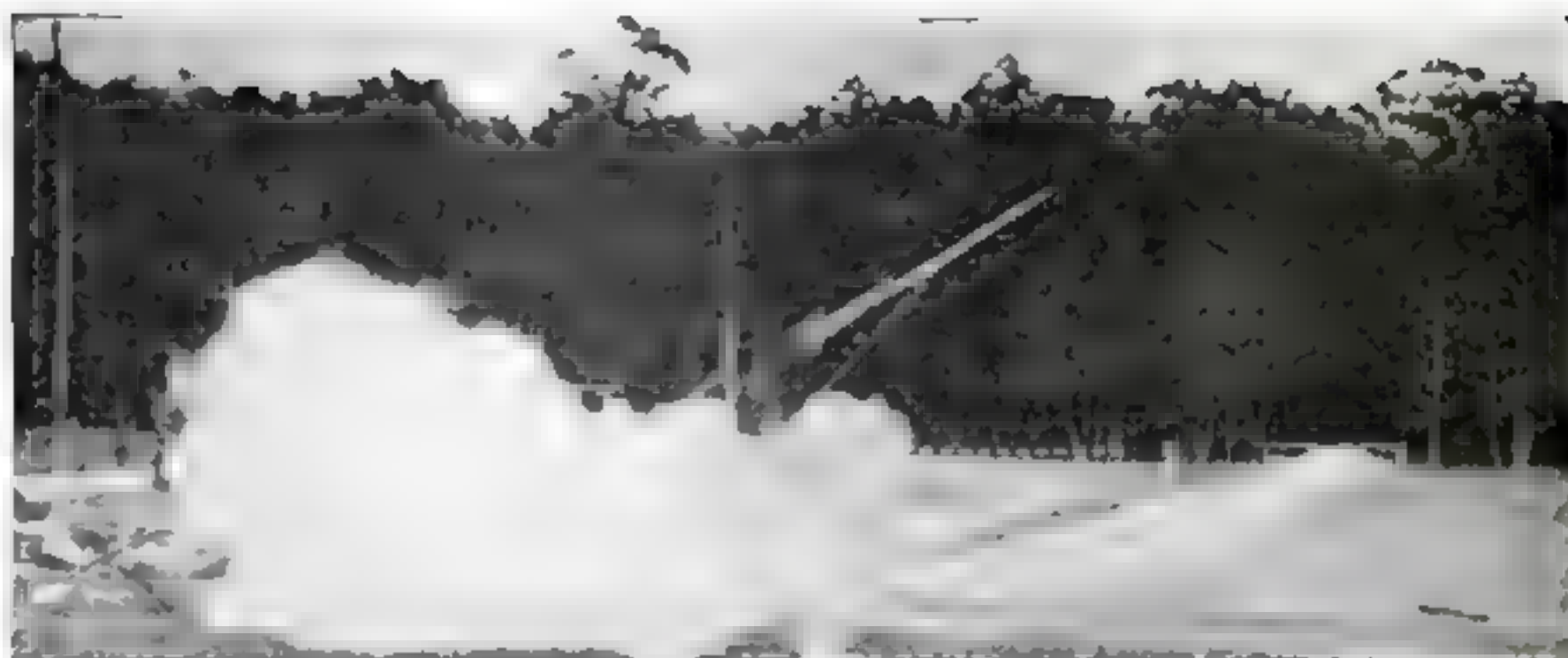
Flying Flyweight. The tiny biplane shown above has a wingspan of 15 feet, weighs 500 pounds, and was built in Milwaukee by Edward Effenheim (right) in his spare time at a cost of \$500. His companion is Robert Huggins, who took the plywood midget aloft on its first flight.



How to Fly a Connie. Complete even to simulated engine roar, this control panel teaches flight engineers the niceties of operating four-engine Constellations. Instructor sets up flight conditions; student makes his instruments conform.



Jet Maintenance Made Easy. Checking one of the XB-47's six jets in preparation for a test flight, a mechanic demonstrates the accessibility of the big bomber's engines. Their underslung mounting permits the use of an auto-type hood.



This war rocket carried a three-inch rope more than 600 ft. in test as life-saving line-thrower.

War Rockets for Lifesaving

NAVY rockets designed to kill are now being reconverted to save lives—as line-throwers, carrying rescue ropes either to or

from disabled ships. Coast Guard tests show they can snake heavier lines over greater distances than present devices. This may make it possible to make direct connections with lines strong enough to carry a breeches buoy or even tow a vessel. Heat of the rocket is still a problem, however, since it may burn rope or ignite oil-soaked seas.

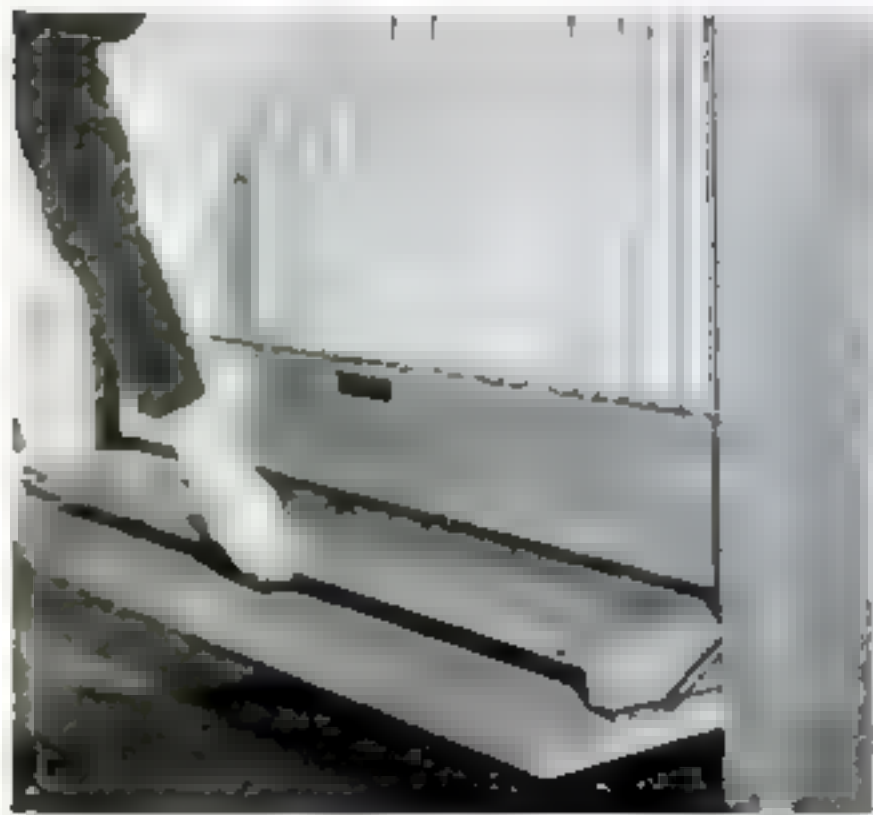


Coast Guard officers prepare to fire rocket with harpoon nose that anchors device in sand.

New Furniture Saves Space



This young lady is preening herself in front of a new dressing table. With the mirror folding out of sight when not in use, it becomes a bureau. Called the "Dress Away," it is made by the Cavalier Corp., of Chattanooga, Tenn.

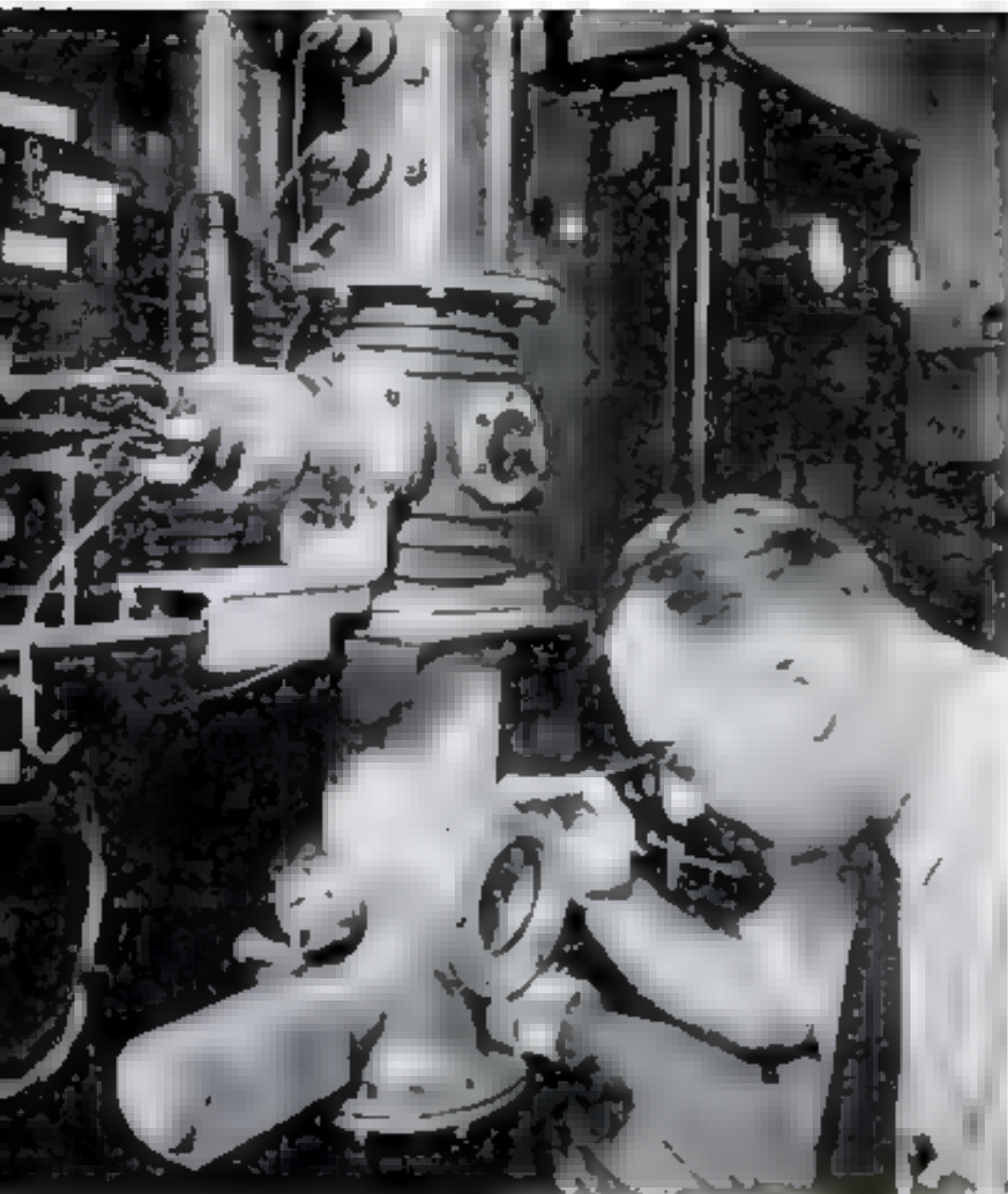


What to do with table leaves that are not in use? Store them in the cellar or just let them clutter up the dining room? This new buffet solves the problem by providing flat storage space for unused leaves as shown above.



A comfortable bed, this new "Sleeprite" also supplies that much-needed, extra closet space. Drawers at the foot, as shown above, provide ample storage space for bedroom linens. These

and many other space-saving, double-duty innovations in functional furniture design were featured recently in a showing of new styles at Chicago's Furniture Mart.



Hot Metal Portraits

HIGH-SPEED electrons and a tiny electric furnace have been teamed in a new camera that snaps pictures of metals as hot as 2,000°. It was developed by Westinghouse research engineers to study the causes of rust and corrosion in metals and alloys at the extreme temperatures they have to take in jet engines and gas turbines.

Main part of the camera is a five-foot-long hollow cylinder seen in center of the picture at left. Electrons shot out of a gun at the top smash against a sample of metal or alloy, placed inside the lower part of the camera and heated to the desired temperature by the electric furnace seen jutting out at the far left. The electrons then bounce off and strike a photographic film. A viewer enables the engineer, as shown here, to examine the hot-metal portrait in the camera. The pattern traced by the electrons tells how oxidation or corrosion takes place. Studies so far have revealed that corrosion increases very rapidly when metal is subjected to high heat—multiplying as much as 10 times for every 100-degree rise in temperature.



Peeking Inside Pipes

YOUR plumbing is a problem only when something goes wrong. Hydraulic engineers of the National Bureau of Standards, however, take plumbing to heart. They want to know just what happens when a toilet is flushed or a drain plug is pulled. To aid their study of plumbing problems, transparent plastic pipes are used in the full-scale home plumbing system shown above.



Household Hideaway

IF YOU want your valuables close at hand, this floor safe looks like a good bet. Built like a milk can, vanes welded to its sides keep the steel case from turning when buried in a concrete block. When the key is inserted in the safe's lock, as shown above, the center compartment pops up to permit the circular head to be lifted. It is made by Nu-Way Industries, of Chicago, Ill.



David E. Lilienthal, chief of the Atomic Energy Commission, smiles disarmingly across the desk that keeps him at the head of things. He designed this one while Chairman of TVA.

Atom Boss Designs Own Desk

LITERALLY surrounded by work, David E. Lilienthal, busy Chairman of the Atomic Energy Commission, spends most of his time on the business side of a massive, functional workbench that all but encircles him with efficient-looking pigeonholes and plentiful



Front view of the Lilienthal desk shows its horseshoe shape. Construction is novel in the use of a special, TVA-developed, six-ply laminated wood composed of lumber that was form-

erly discarded. The top ply is made of first-grade oak. The desk was built by two TVA employees: Mack Bloomer, who did the carpentry, and Walter Cloyd, who did the finishing.

work space. Its peculiar shape, which defies geometric definition, looks something like a horseshoe on the bias.

Stranger still, perhaps, is the origin of the odd design, since it dates back to a time in college when Lilienthal suffered an ankle injury playing football. To make studying easier, he arranged several desks around him in a semicircle, one of which was an old-fashioned secretary with plenty of pigeonholes. It was the use of this desk that established the supremacy of pigeonholes over drawers for storage space.

Years later, a second version of the desk, a makeshift table consisting of eight-foot-long planks laid over trestles, saw him through 13 years as a director of the Ten-

nesses Valley Authority. This model had the pigeonholes, now widened to take papers flat, but was not curved. Lilienthal says he finally tired of reaching for everything and "simply pulled in the ends" around him to make the semicircular shape.

The latest model, shown here, looks a little like a railroad roundhouse and is just as efficient. The right side, slightly longer than the left, creates an attached conference table for the inevitable meetings.

Except for its size and shape, the desk is conspicuous in its simplicity. Its modest appointments include a single phone, a lamp, an unornate desk set, and some family pictures. It has no radio, television screen, or built-in bar. It's made for work.



Pigeonholes seen here keep work from being buried in drawers. Longer right side makes room for papers and meetings, is still within arm's reach. Edge shows how waste wood was

used in six-ply construction. Note blotter curved to fit. Wooden chair was substituted for photographic purposes. At work the AEC boss uses a leather swivel chair for easy maneuverability.

Body Can Take Heat



Variations in temperature of air as it is breathed in and out are measured by these thermocouples inserted in nose and mouth. These special thermometers reveal that the body acts as a refrigerator, remaining as much as 100° cooler than the temperature in the hotbox.



Getting ready for the hotbox treatment, this UCLA engineering-student volunteer is dressed in a harness to which nine thermocouples are attached. These sensitive instruments register external skin and body temperatures on the forehead, right chest, left back, abdomen, left upper arm, right forearm, right calf, and left foot. While the subject is sweating it out, frequent readings are taken and instantly recorded on a moving tape for later study.

Shown in close-up above, thermocouples consist of crossed iron and constantan (an alloy of nickel and copper) wires. They are held against the skin by a plastic bridge. In addition, the "victim" from time to time presses a tiny auxiliary thermocouple to one eyeball.

that Boils Water



Wearing jacket, trousers, and canvas overshoes, the guinea pig, seated in a tracked chair, is shoved into the oven. The thermometer rises to 220°. Water would boil, and eggs cook, but he takes it without too much discomfort. At the end of 15 minutes, he's gasping for breath, sweating profusely, and in a fighting mood—but otherwise in comparatively good shape.

SWEATING it out in a metal box at more than 250° F., University of California at Los Angeles experimenters have proved that the human body can take temperatures that would cook meat and boil coffee—but only for a short time. The tests are being conducted for the U. S. Air Force to find out how pilots would react should the cooling apparatus fail in the supersonic planes of tomorrow (see Cooling "Hot" Pilots, p. 110).

The reason the body can withstand temperatures previously regarded as fatal is that it acts as its own refrigerator. Evaporation of moisture through the skin forms a boundary layer of cool air in which the body wraps itself. Subjected to temperatures of 200° F. and more the skin heats only to about 105°, while the body hovers around a safe and fairly comfortable 100°.

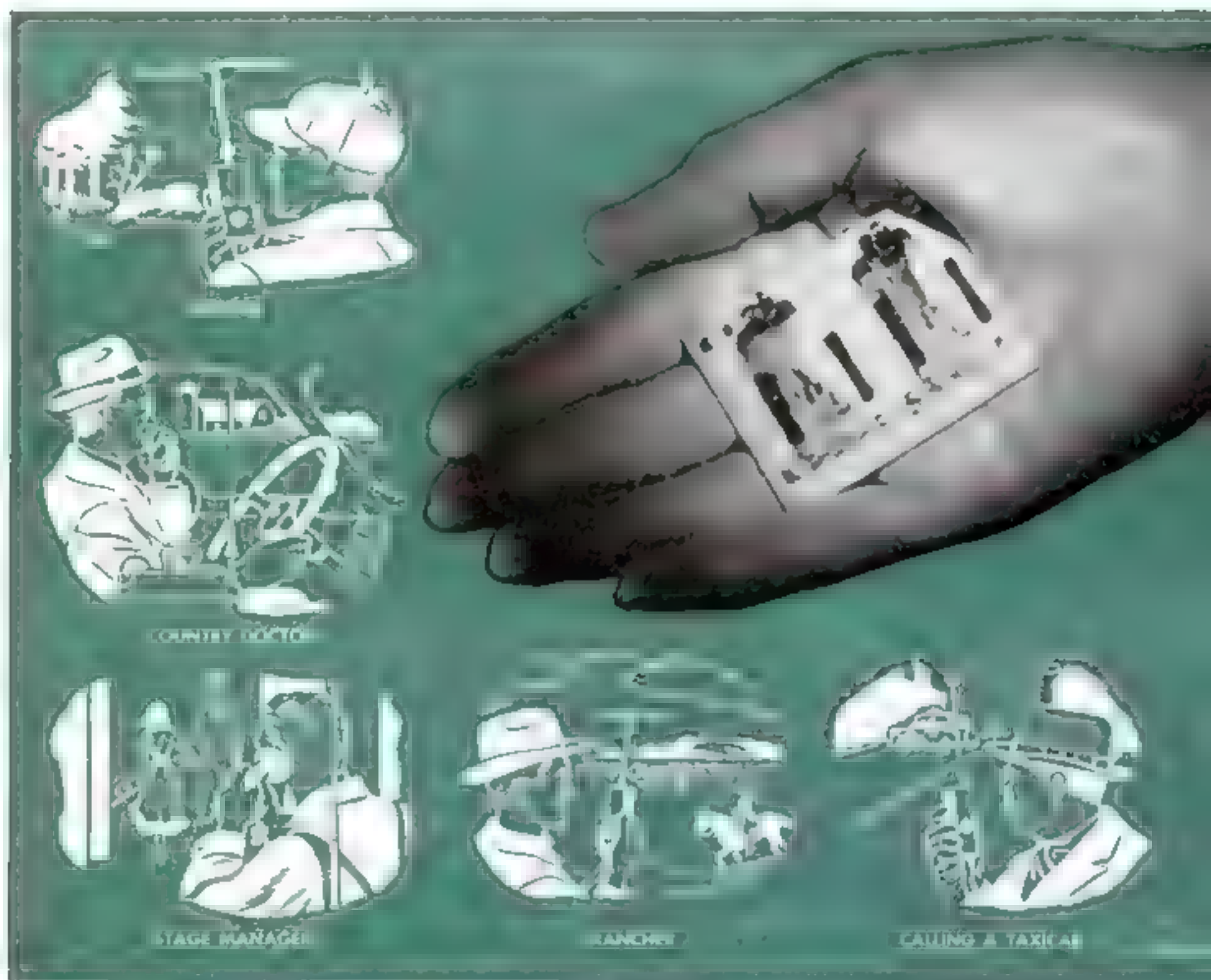
The sweatbox used in the experiments is a metal-sheathed cylinder, five feet in diameter, that served to test aircraft instruments during the war. Electric strip heaters, thermostatically controlled, produce any desired heat. Already several volunteers have taken 220° F. for 15 minutes and more. Dr. Craig Taylor, in charge of the project, has "cooked" at 262° for two minutes, and is warming up for a 300° session.

How Wrinkleproof Is Your Suit?

You get the answer on the first muggy day you wear that natty, new, double-breasted job. But perhaps you'd like to know before you buy. That's what this wrinkle meter, developed by Monsanto Chemical Co., is for. Ordinary methods of testing the "bounce" of fabrics do not allow for changes in temperature and humidity, gravitational effects, and human error. The new wrinkle tester, it is claimed, permits accurate measurement under all conditions.

For testing, such materials as woolens, worsteds, cottons, or rayons are creased and mussed. One end is then inserted in a jaw of the meter, the other end hanging free. The degree to which the free end "bounces back" is then read on an "angle of recovery" scale graded from 0 to 180°. A reading of 100° is considered to be a reasonable guarantee against baggy pants.





Coming—the Radio that Was Shot from a Gun

The tiny elements used in a great war invention are now ready to go to work in civilian transceivers.

By Harland Manchester

CARRYING a complete broadcasting station in the palm of his hand, a radio engineer walked out of his laboratory at the Bureau of Standards in Washington the other day, talking as he went down the stairs and out of the building. His voice

came to us from a loudspeaker in the room he had left, as clearly as if he were still there. His transmitter, containing microphone, tubes, circuits, batteries, and aerial, was enclosed in a plastic box about the size of a pack of cigarettes.

This is one of many types of subminiature radios, developed at the Bureau of Standards and elsewhere as a result of wartime research, which a dozen manufacturers will soon offer to the public. There are receiving sets the size of a fat wallet, which pick up

standard radio programs, and two-way radio sets to be carried by a shoulder strap like a camera. In the Bureau's laboratories there are short-range broadcasting stations the size of a lipstick, with certain tubes little larger than a grain of rice, and other transmitters about as large as a thick powder compact, which can be worn on the wrist, with midget batteries concealed in the strap.

These amazing little radios were sired by one of the most devastating new weapons of World War II—the proximity fuse. This is a radarlike device, mounted in the nose of an artillery shell, which detected the presence of enemy planes and caused the shell to explode if there was a plane within a radius of 70 feet. Before its use, anti-aircraft fire was notoriously ineffective. In the Battle of Britain, it took 2,500 shells, with good marksmanship, to bring down one German plane. British and American scientists conceived the seemingly impossible notion of sweating down a radio sending and receiving station into a space the size of an ice-cream cone, so that it would fit into the nose of a shell. This ambitious project was carried out by the Office of Scientific Research and Development, with Dr. Merle A. Tuve heading a group that included many of the country's leading physicists and corporation representatives.

Tubes Tiny but Tough

Sturdy little radio tubes smaller than a half-smoked cigarette were already being made for hearing aids. These were made still smaller, and so strong that they could be fired from guns at a force 20,000 times that of gravity without breaking the glass walls or the fine filaments. Before V-J Day, 130,000,000 of these tubes had been made

by Sylvania Electric Products, Inc., and other firms, and the cost had approached that of many standard tubes.

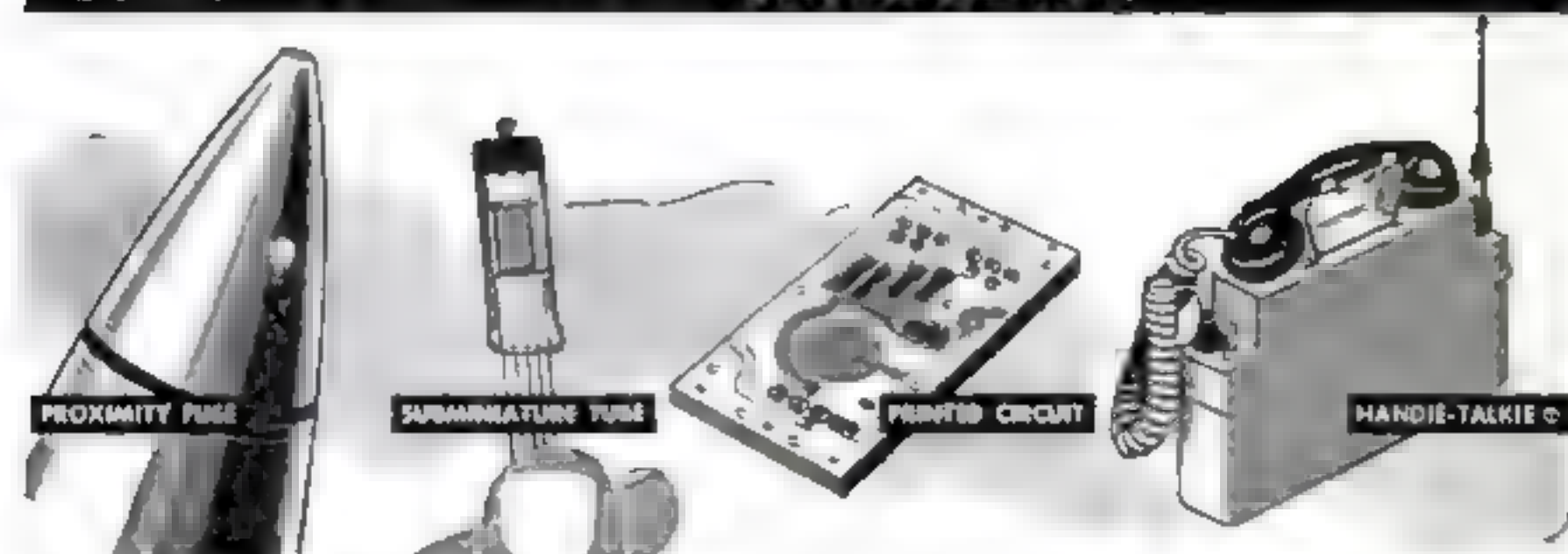
Rugged miniature batteries of new design were also developed, and the parts were cleverly assembled in the incredibly small space. The result was one of the greatest advances in modern warfare. For the first time in the history of fighting planes, anti-aircraft fire became effective. German V-1s and Japanese Kamikazes triggered the shells as they came within range of the tiny radios and were blown to bits. Entire German battalions were wiped out in the Battle of the Bulge as proximity-fused shells exploded at a lethal distance above ground, making shelter futile.

A further development, which came late in the war, was the printed circuit. Look in the back of your radio and you will see a baffling maze of wires strung in place laboriously by hand. This has long been one of the bottlenecks of radio manufacture. So, using an idea that had been hanging around for years, engineers of the U. S. Bureau of Standards and Globe Union, Inc., of Milwaukee, learned how to print, stamp, or stencil the wiring on thin plastic or ceramic sheets. Little lines made of thick silver ink carried the current through its paths, and an ink containing powdered carbon was used for resistance circuits.

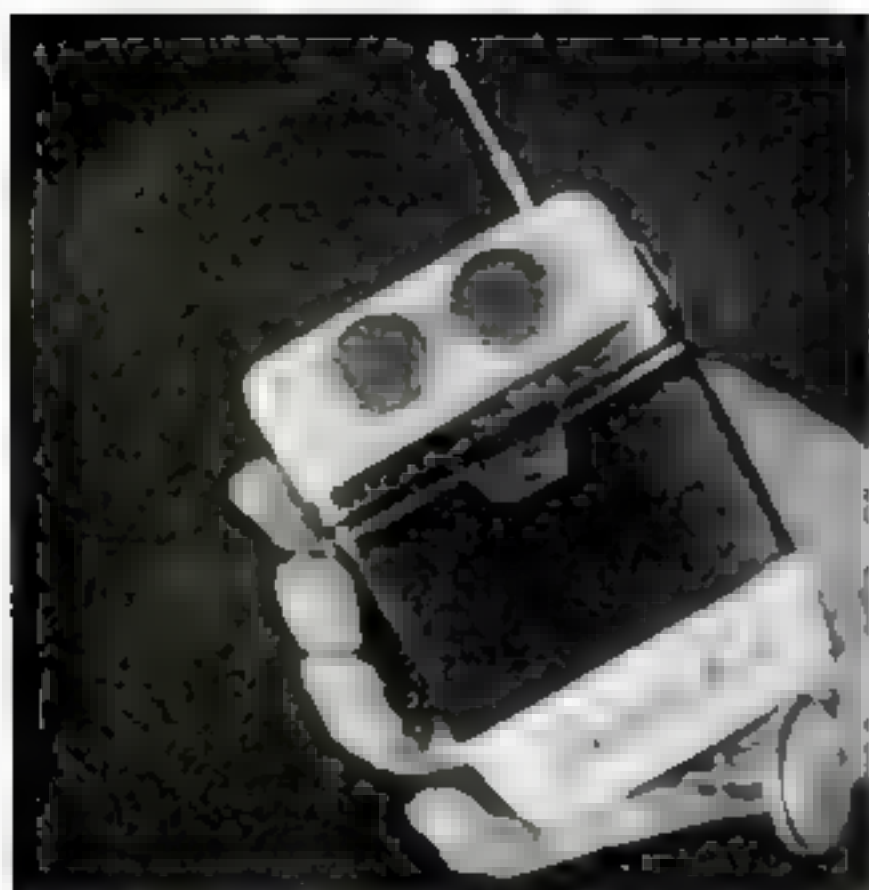
This process has been perfected to the point where the circuits of a miniature radio set can be printed on a bit of plastic the size of a calling card. These circuits perform as well as wired circuits, and are less likely to get out of order. As an ultimate refinement of miniaturization, the wiring has actually been etched on the little glass tube itself.

It cost America \$800,000,000 to develop

STEPS TOWARD POCKET BROADCASTING



Fuse fathered tiny tube and printed circuit; Handie-Talkie ® presages pocket transceiver.



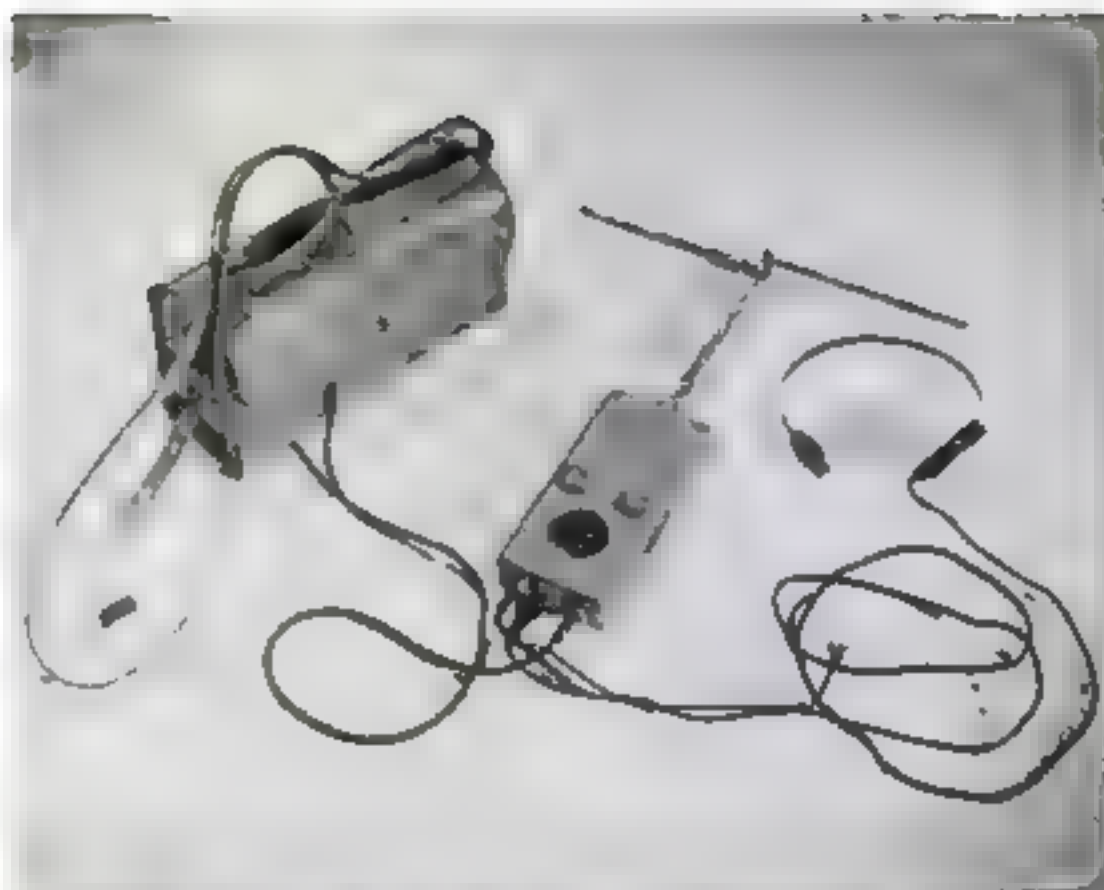
This Earadio Ⓢ weighs 8½ oz., measures 3½ by 4 3/10 by 1½ inches. Retractable antenna is on top, earplug is metal disk at bottom. It is made by Masterpiece Radios, Inc.

and produce this epochal weapon. Since the war, Dr. Clelio Brunetti and half a dozen co-workers of the Bureau of Standards have spent their spare time converting the radios that were shot from guns into sets for civilian use, and a large section of the industry is tooling up to build them. Soon we are to get returns on our investment, in the form of pocket radios with a thousand and one uses. And in a few years the midget tube and the printed circuits, built into everyman's radio, should cut its size, weight, and cost, and make repair jobs easier.

Ear Aid First to Use New Printed Circuit

The first printed-circuit device to reach the market is a six-ounce hearing aid little larger than a cigarette pack. The makers, Allen-Howe Electronics Corp., of Peabody, Mass., achieved this result by boiling down the 173 items of the old amplifying system, including wires, screws, soldered joints, and tube sockets, so that it could be mounted on a printed ceramic wafer about half as big as a graham cracker.

Using the tiny tubes, printed circuits, or both, three firms, Raytheon, Masterpiece Radios, and Modernair, will soon bring out pocket radios that will pick up standard broadcasts. As highly styled as cigarette or vanity cases, they measure about three by five inches, and an inch or less thick, and weigh as little as nine ounces complete. These personal portables have earplugs at-



Ultraphone Citizens Radio Ⓢ is transceiver designed for FCC's forthcoming Citizens Radio Service. Six inches high, it weighs 2½ lb. with batteries. Folding dipole antenna plugs into top.

tached to thin wires, and are no more conspicuous in use than hearing aids. They have the usual knobs for tuning and volume control. Estimated prices range from \$20 to \$65. They will probably become popular as de luxe gifts for travelers.

Many firms are rushing light, portable transceivers, as two-way radios are called, for the new Citizens Radio Service, an exciting field of communications that should be ready for the public soon. Three years ago the Federal Communications Commission, spurred by the zeal of Commissioner E. K. Jett, set aside the new radio band for any citizen, firm, or organization to use in transmitting business or personal messages. Over this band the doctor can talk with his office, the reporter with his city editor, the husband with his wife, or the hunter can ask the boys at the camp to come and help him bring in a deer.

Among the few restrictions: paid messages cannot be sent, programs cannot be broadcast, and licenses to use sets will not be issued to aliens. All users will be licensed at no cost. Since the band (460-470 megacycles) is in the ultra-short-wave part of the radio spectrum, transmission is roughly limited to line-of-sight. This means that while a fire watcher on a mountaintop or a passenger in a plane might talk with someone 100 miles away, surface communication would be limited to about five miles.

Several hundred two-way portables are



The Solo-Pak ① is one of the tiniest single-unit hearing aids yet devised. It uses new printed circuit, smaller than a playing card and only 3/32 inch thick, claims greater efficiency.

now being tested experimentally by police, firemen, geologists, and motion picture producers. Because of the narrow band allotted, not more than 50 conversations can take place at once in any one area. But if users wait for the other fellow to finish, as they do on a party line, everyone in a town of 1,500 who wants a set should have ample time on the air.

Scores of practical jobs are being proposed for the new service. The Gross Electronics Corporation, of Cleveland, is making a two-and-a-quarter-pound set to be carried by shoulder strap like a small camera, and reports that a newspaper has ordered sets



The Acousticon Radion ① combines a tiny hearing device with an even tinier radio, shown at right. Radio simply plugs into the side of the aid, imposes no extra battery strain.

for reporters. A steel firm wants it for interplant communication by peripatetic foremen, inspectors at a railway food terminal wish to try it out for making reports on the condition of carloads of produce, and the ground keeper of a big cemetery wants a set for reporting the condition of graves.

The military type of "walkie-talkie" was once used by a group of hunters in closing in on a bear; citizens' sets can be used in the same way. They should be of particular value to guards and watchmen, foresters, ranchers, and lumbermen. Their use is foreseen in co-ordinating activities of yacht fleets, motor caravans, parades, and county fairs,



The tiny ceramic wafer at right is the printed circuit developed by Allen-Howe Electronics Corp. for their Solo-Pak ① aid. It replaces the 173 items jumbled together in the foreground.



The Handie-Talkie ①, developed by Motorola, enables a farmer to radiophone right from his tractor. An FM transmitter-receiver, the 8½-lb. unit is designed for the 23-44-mc. band.

and for emergency communication systems when storms and floods knock out phone service. Owners of small private planes will probably use them for ground communication, and, of course, a lot of people, like the boys on the amateur band, will use them just for fun.

A good example of the value of short-range radio can now be seen at Lake Success, where proceedings are speeded up 50 percent by light portables passed out to delegates. Speeches are translated and broadcast simultaneously in English, French, Russian, Spanish, and Chinese. Delegates tune in on their own wave lengths, and can leave the room without missing anything. It would be technically possible to set up telephone relay stations so that people at public gatherings or on beaches could make calls via pocket radio.

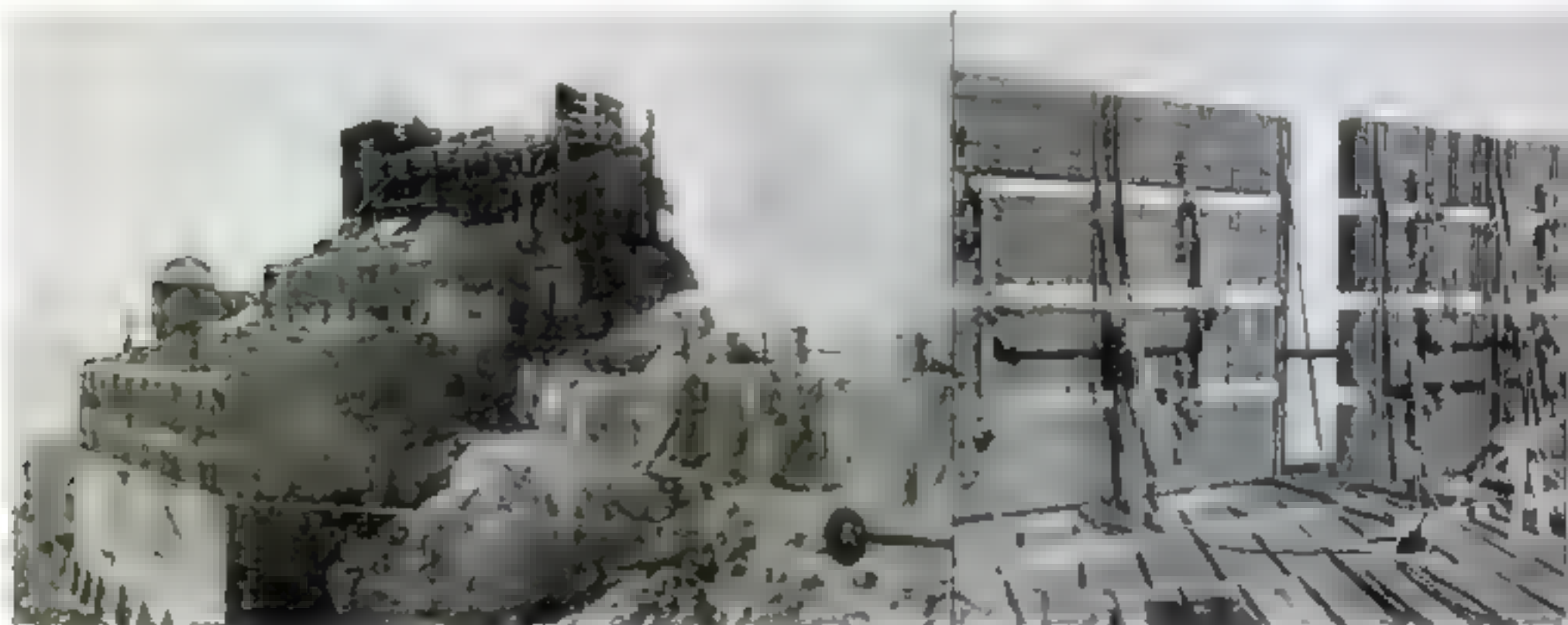
Smaller Tubes Mean Lighter Planes

Tiny radios are only one result of the great wartime project. General Electric engineers predict that in a few years a large transport plane will carry more than 600 electronic tubes, which at present weigh 225 pounds, while the same number of miniature tubes tip the scales at 37 pounds. Space is also saved, and the tubes are so sturdy that you can safely bounce them on the floor.

The new tubes, together with the printed circuits, seem destined to usher in a revolution in radio sets and other electronic devices. By printing or stenciling the wiring circuit on a plate, one workman can turn out about 500 circuits in the time it now takes him to wire one set. There are about a hundred soldering operations in the average household radio set; printed circuits may eliminate half of these jobs, with important savings in labor and materials.

A plastic block on Dr. Brunetti's desk, resembling a paperweight, gives a further glimpse of the radio of tomorrow. This is the new "potted" radio developed at the Bureau of Standards. Circuits and tubes are embedded in a special plastic like flint in amber, to protect them from shock, moisture, and mildew. Plug the protruding wires into loudspeaker, tuner, and light socket and you have a working radio.

It may be some time before all these developments are adopted by the radio industry, but all signs point to smaller, cheaper, more durable sets composed of a few simple parts that anyone can plug together. Today you can buy a radio for \$30 that will outperform the \$200 set you bought in 1927. This was brought about largely by simplified manufacturing processes. Now engineers see an even greater transformation on the horizon. END



Aerie Houses Relay

THAT'S not a medieval castle perched up on a mountain peak, above left. It's a wireless-telephone relay station on the top of the 9,738-foot Zugspitze, highest moun-

tain of the Bavarian Alps, near Garmisch, Germany. One of three between Munich and Frankfurt, the station has been released for German use and is manned by five German technicians. Above, at right, is a close-up of the rear of the station's antenna.



Horn Honks Warning

ENGLAND's pea-soup fogs often blanket railroad signal lights. Now a British engineer can "hear" the signals by means of a horn that blows in the locomotive cab *before* he reaches a signal. Inductors (seen in center of track, left, above) activate a magnetic

mechanism (seen suspended below center of locomotive truck, right, above) that blows the horn. If the track is clear, the horn shuts off after 1½ seconds. If it continues to blow its warning, and the engineer doesn't turn it off and apply manual brakes, automatic braking mechanism goes into action, stopping the train within a safe distance.



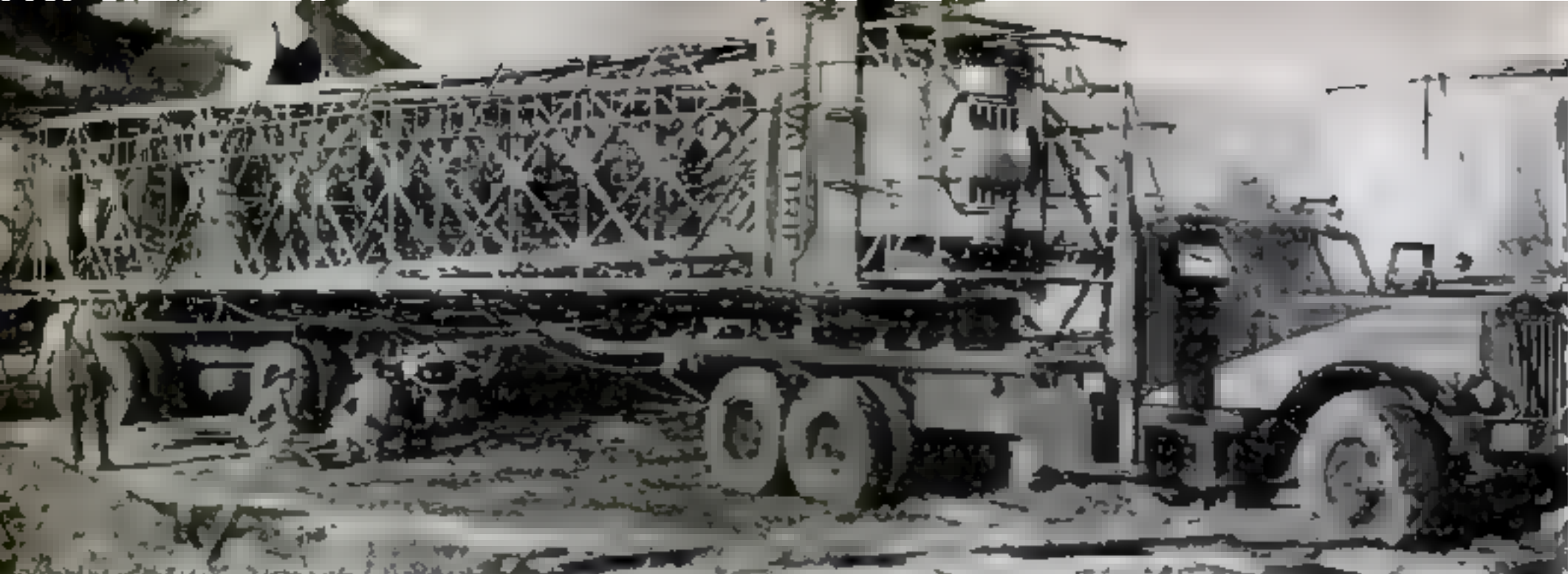
From Egg to Chirp

EVER watch the birth of a baby chick? Well, here's a novel device that lets you see all at a minimum of inconvenience to both you and the chicks. Swamped with requests to witness the hatching of chicks, the Ketay Hatchery, of Huntington, N. Y., came up with this transparent incubator. Four trays under a plastic dome permit a number of people at the same time to see the entire process, from the first peck of beak through the shell to the fluffy one-day-old chick. Every day a new tray of 19-day-old eggs is added, and a tray of fully hatched chicks is removed. Thus all stages of birth are always on display to interested spectators.



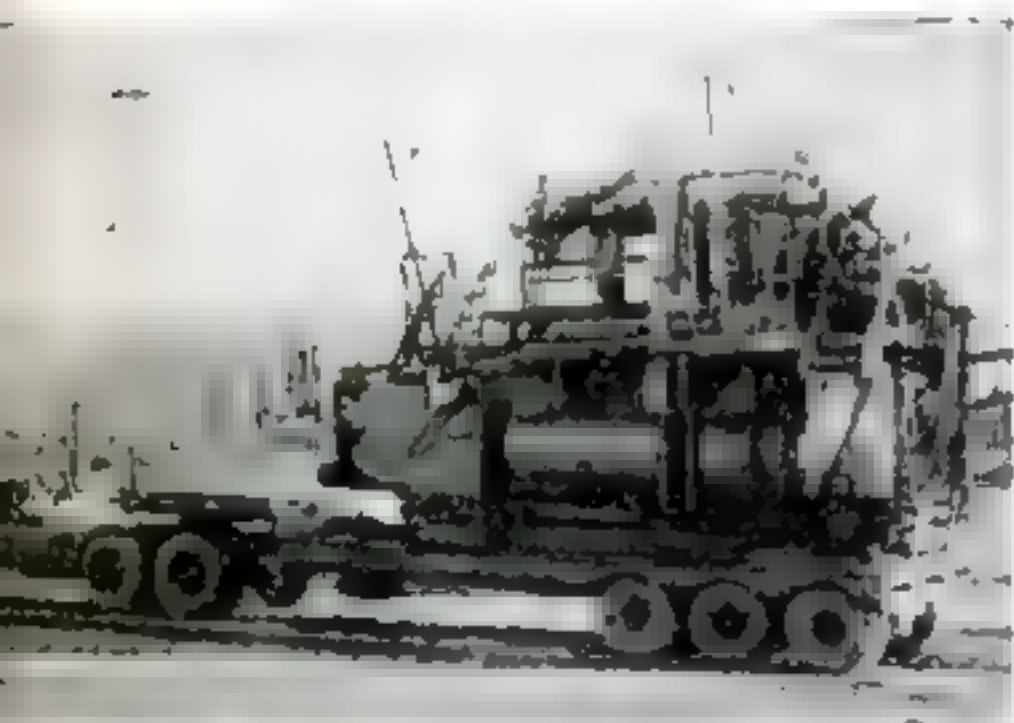
Diesel Is Lightweight

EVEN at high speed (1,800 r.p.m.), there is little vibration in this new 37-inch-long Diesel engine that weighs only 607 lb., yet develops 15 hp. A decompression chamber eases hand cranking and standard gear housings allow a selection of starting power. Its builder, the Standard Machine Works, of Pasadena, Calif., claims that an early model has powered a 30-foot fishing boat for five years at a cost of five cents an hour.

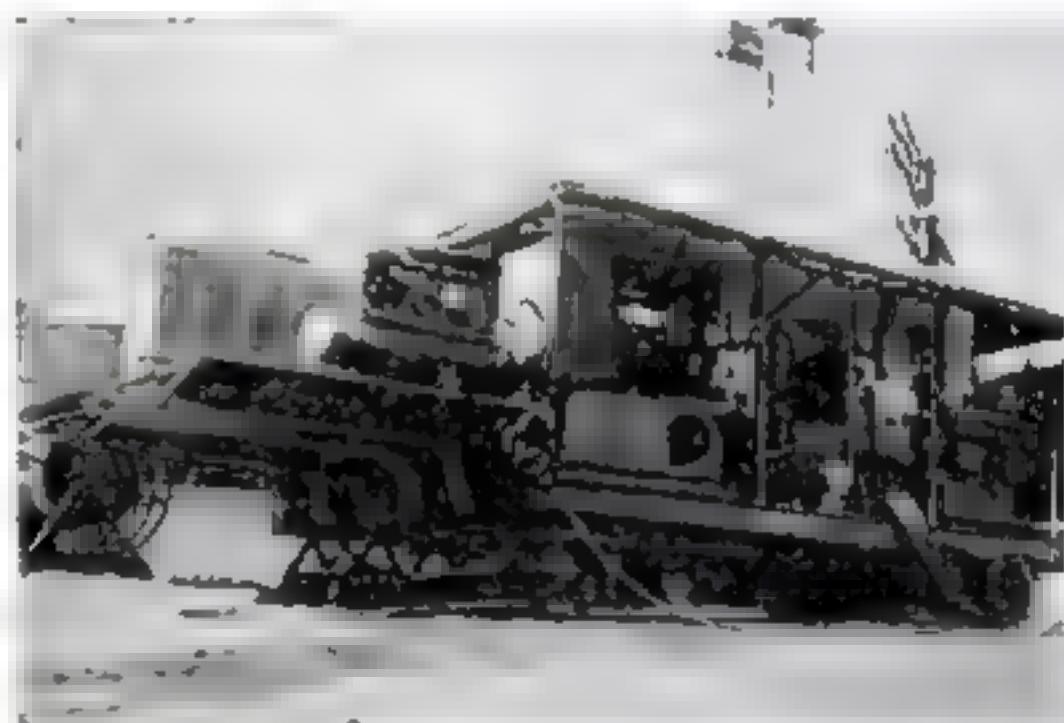


To meet the legal limits for highway transportation, the huge derrick with blocks is packed into a trailer-borne package eight feet square and 63 feet long. It weighs approxi-

mately 36,000 pounds. Special trailers were made by the Fruehauf Trailer Co. Mobile derrick can be erected and set to work within a few hours after reaching its destination.



All accessory equipment is equally mobile. Here draw works, complete with walkways, stairs, and raised catheads, all mounted on a turntable, are transported on a three-axle trailer.



This 12-cylinder engine drives the generator. It operates on natural gas, gasoline, or butane. To move the unit, a semi-truck backs under the forward platform and drives away.

New Derrick Has Long Stretch

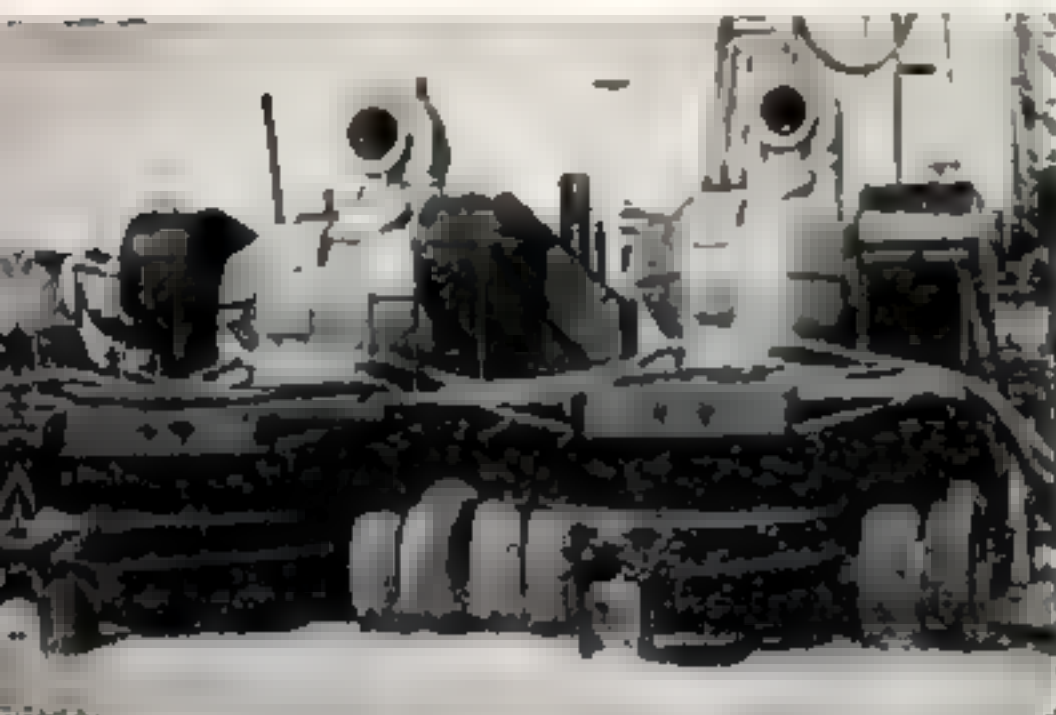
IN OPERATION the twin masts of this new oil derrick rise to the height of a 12-story building. Yet the 18-ton, 123-foot steel structure can be telescoped and moved from well to well in a 63-foot long-trailer-size package. Shell Oil Co. engineers, who developed the new rig, estimate that its mobile feature will save an average of \$5,000 in the cost of drilling a single oil well.

Electrically operated, the rig has a 300,000-pound hook-load capacity. After the two parts of the derrick are elevated by

hydraulic rams, the structure is stretched to its full height by two electric motors driving four sprockets through worm reduction gears. These motors are mounted in the base of the upper section of the derrick. Rotation of the sprockets makes the upper section climb four chains mounted in the lower section. In case of mechanical failure during erection, safety latches built into the bottom section catch and hold the top section. The rig can begin drilling a few hours after arrival at a new location.



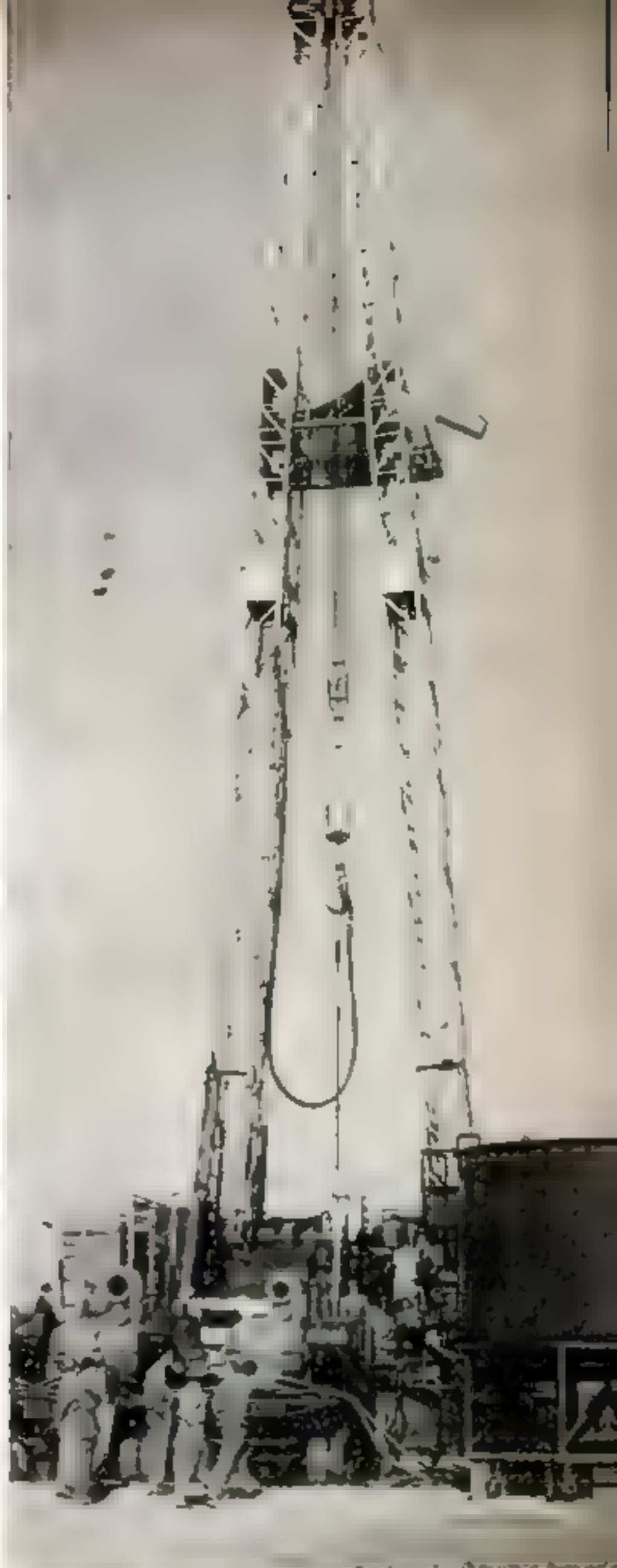
The telescoping rig being raised by hydraulic rams at a drilling location in Shull's mountains, Ventura, Calif., oil fields. Electric motors stretch the rig up to its full height.



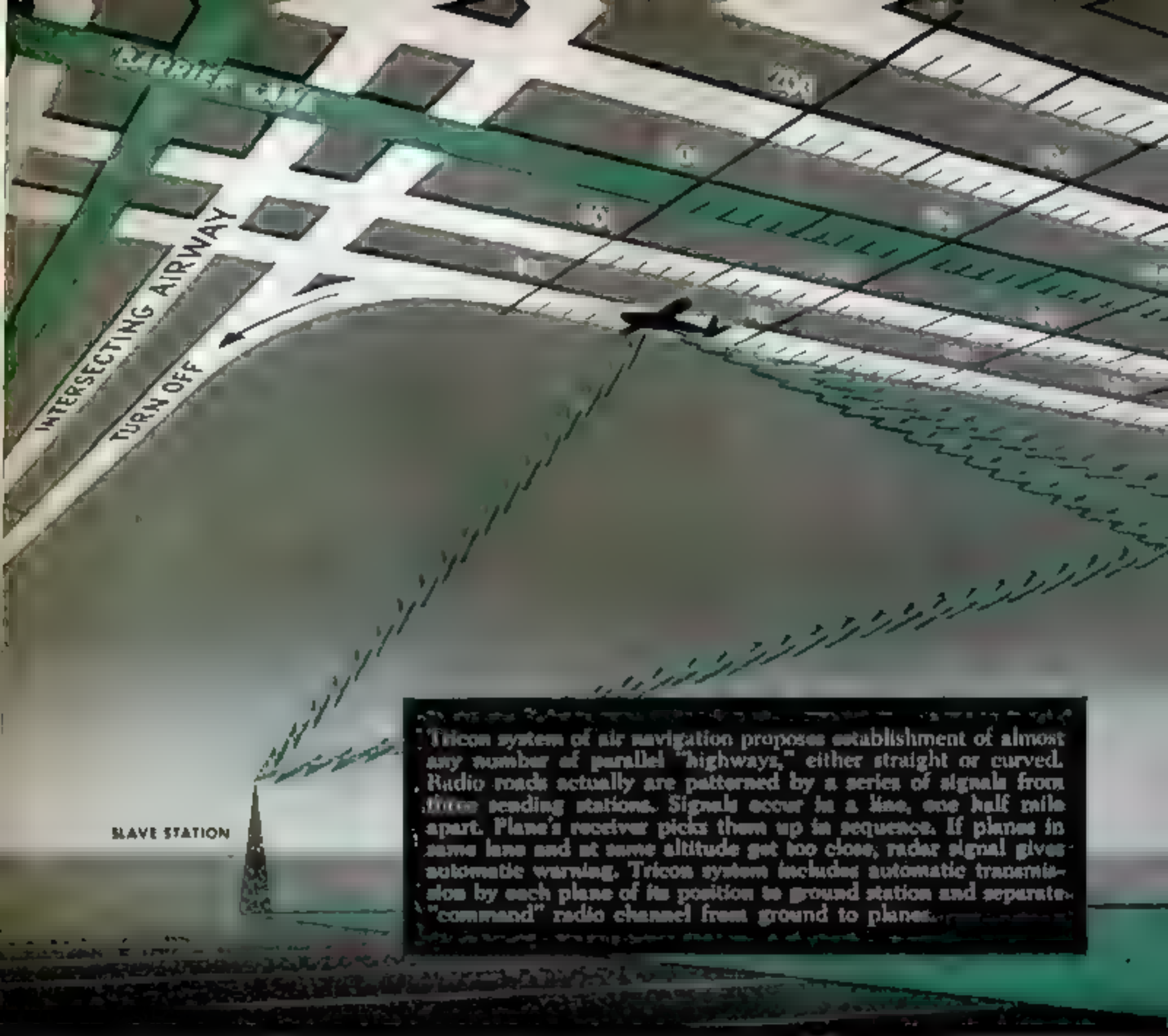
Complete mobility of the entire outfit is demonstrated by these pumps, permanently mounted on trailers that are a part of the pump frames. Eight 10.00 x 15 tires carry the load.



The drilling foreman operates the power plant and keeps the drill working from this central control panel. He is assisted by an elaborate array of electrical devices. A loudspeaker conveys verbal orders. This unit is permanently mounted on a semitrailer.



Lowering 12 stories, the two-masted derrick can drill a hole two miles deep. For night drilling, the working area is illuminated by sixteen 500-watt floodlights seen suspended from the derrick guy lines. The result of two years' research, the unit cost \$250,000.



Tricon system of air navigation proposes establishment of almost any number of parallel "highways," either straight or curved. Radio roads actually are patterned by a series of signals from three sending stations. Signals occur in a line, one half mile apart. Plane's receiver picks them up in sequence. If planes in same lane and at same altitude get too close, radar signal gives automatic warning. Tricon system includes automatic transmission by each plane of its position to ground station and separate "command" radio channel from ground to planes.

Radio Builds Railroads In the Sky

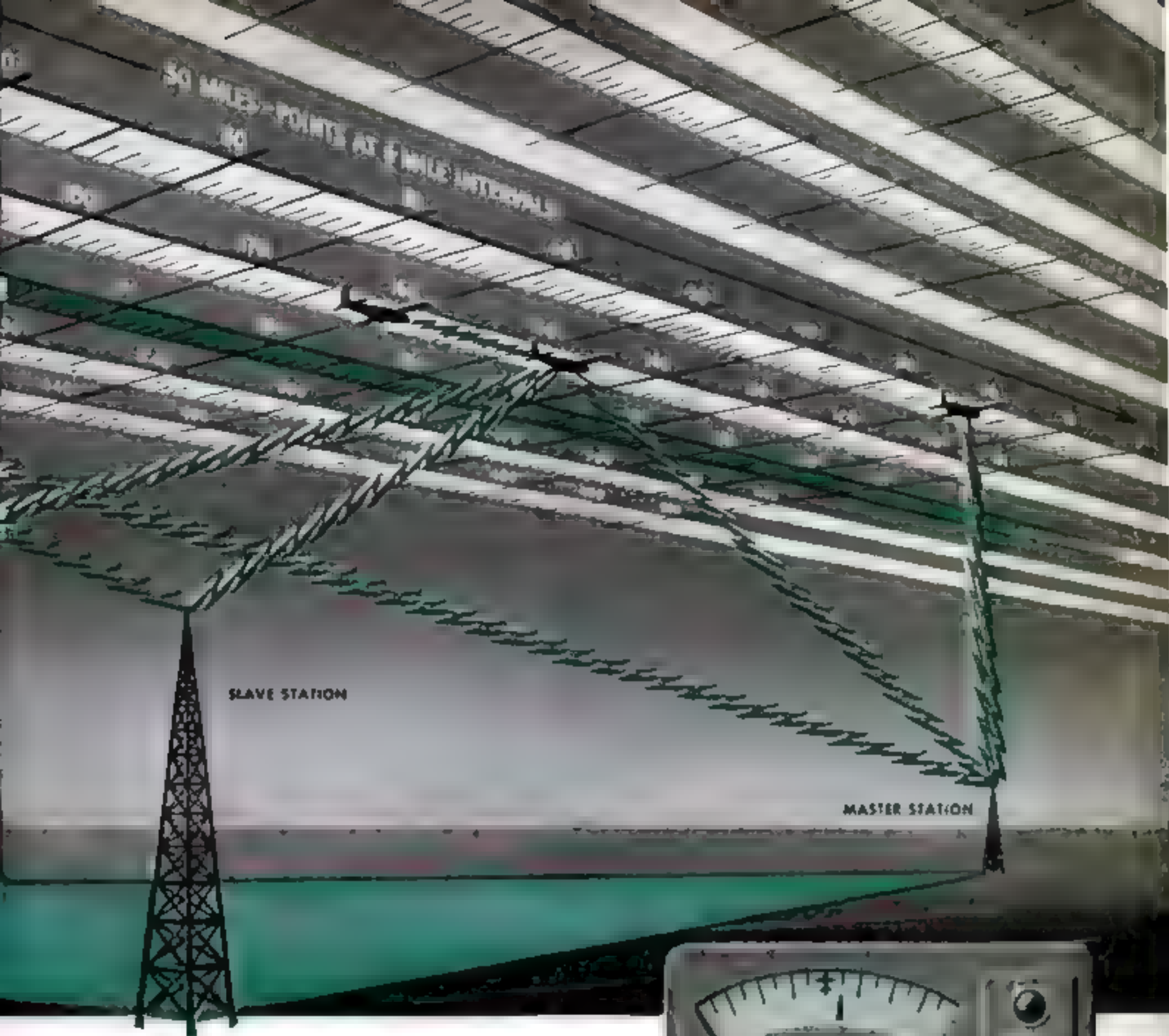
By **Deron Francis**

BORROWING a barrellful of war-refined knowledge about radio and radar, U. S. scientists have come up with a brace of systems for making transport flying as safe and systematic as railroad operation.

One system is called TRICON (for *TRI*ple *CO*incidence Navigation). The other is known as the B-D Computer Aerial Navigation System.

Both are designed to take the nightmare out of navigating in airplane from one city to another when the weather closes down and even the birds start walking. The B-D Computer system also has another feature: it can be adapted for actually landing an airplane automatically with the aid of the federal government's experimental Instrument Landing System (PS, March '46, p. 74).

The present inter-city navigation system,



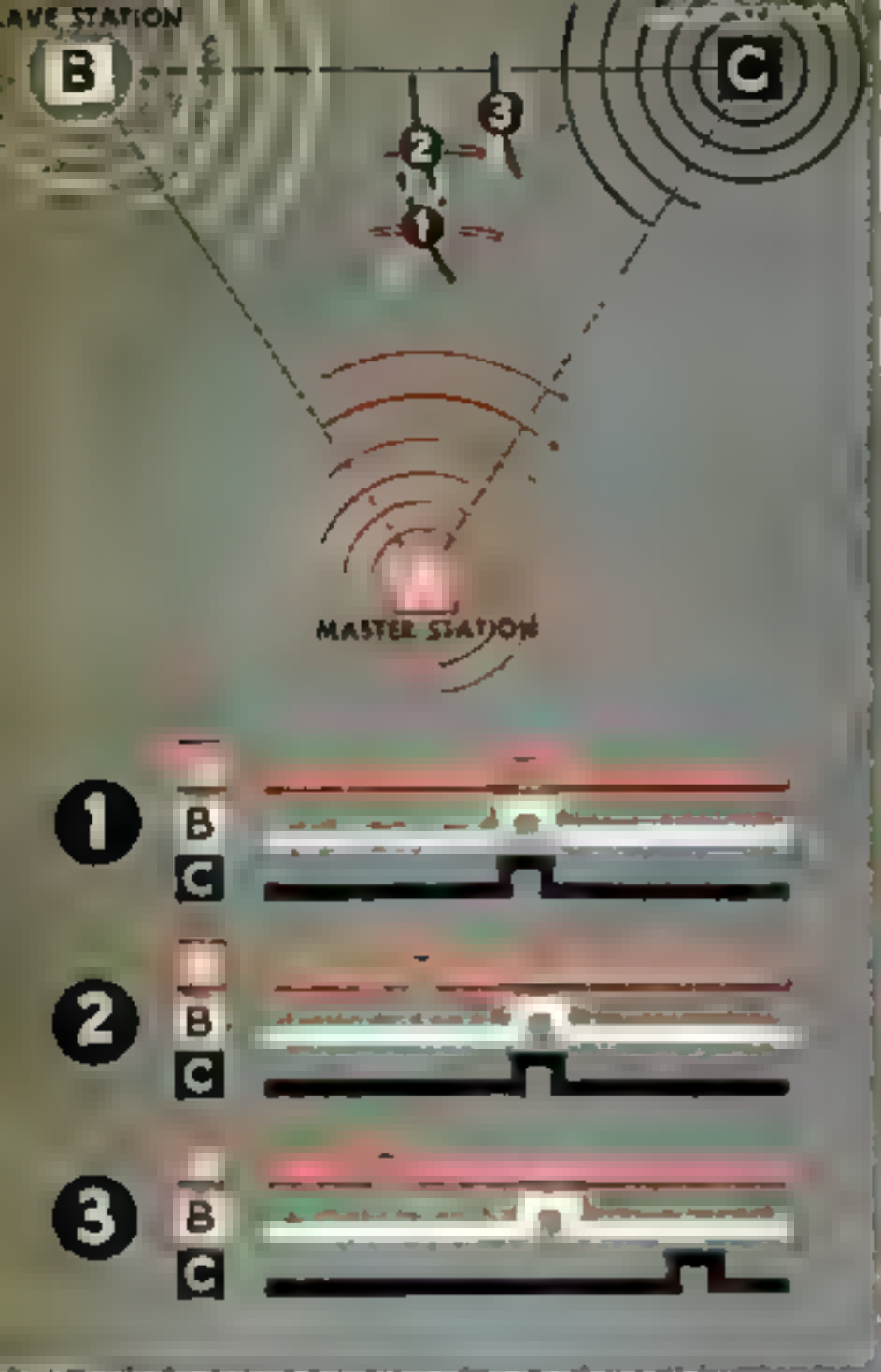
in use for a score of years, has worked pretty well up to now. But the trouble with radio beams, or ranges as they are called, is that in thick weather airplane schedules have to be slowed for safety's sake. A beam provides only two lanes for traffic on any given airway.

The General Electric Co., for which Tricon was evolved, and the Minneapolis-Honeywell Regulator Co., which developed the B-D Computer system, say this is nonsense, and they present some answers.

Under either system, in the air space where only one airplane now flies in soupy weather hundreds could fly in complete safety. Let's look at Tricon first. Ever lose a favorite fishing rod over the side of the boat? After you got control of your temper, you took a line of sight on a tree on shore,



Proposed cockpit instrument panel gives pilot course deviation, airway number, lane identification, plane's altitude, mileage flown. Buttons and lights let him examine occupancy of lanes above, below, and on each side. Vertical lights at right are for commands from the ground.



Heart of Tricon is pattern of signals from three stations. In pattern 1, all stations pulse together, placing point of triple coincident reception equidistant from transmitters. In patterns 2 and 3, pulses lag, displacing points of simultaneous reception.

and then on another one some distance from it, and calculated the angle between them.

You did this so you could locate the spot where the rod had disappeared when you returned with a grapple. You oriented yourself. You "triangulated." Tricon proposes to create a whole scad of superhighways for transport planes on every airway in the United States with wholly automatic triangulation by radio.

Navigation by triangulation is nothing new. Transoceanic planes have used it for years. War's Loran system (PS, Feb. '46, p. 78) was, in essence, a means of locating an ocean vessel or plane by measuring angles and computing distances. What makes Tricon interesting is the way its originator, Dr. Luis W. Alvarez, of the University of California, proposes to do his triangulating.

As in Loran, he would use a "master" and a couple of "slave" radio sending stations. Each leg of the triangle separating them

would be many miles long. They would "scan" a total distance of about 50 miles.

Families of these stations would be built at intervals along each heavily traveled airway. For every half mile of travel, a pilot would be advised by an indicator on his instrument panel whether he was where he was supposed to be. And this is the way Dr. Alvarez says it would work.

Radio pulses travel at a fixed speed. That's about 1,000 feet each millionth of a second. Now, supposing the "master" sending station and the co-ordinated "slaves" emit signals at the same split second. Any receiving set equidistant from all three stations would experience a simultaneous reception—the signals would come in by *TRIPLE COINCIDENCE*.

Secret Is in Timing of Signals

But if timing of the signals was slightly off—if the slaves lagged behind the master, for instance, by a millionth of a second—the point where their reception coincided would be 1,000 feet away. The master's signal would have traveled 1,000 feet while the slaves were making up their minds to send.

That's how Tricon sets up superhighways in the sky. By giving the sending stations a progressive change of pace, 500 times each second, 500 successive points at which their signals are received in triple coincidence are established. By juggling the order in which the three stations pulse in each one of those 500 separate cycles, just that many triply coincident signal locations can be spotted along a given airway. At none of them is the sending sequence of the three stations exactly the same.

So far, so good. Why 500 different sending combinations? Dr. Alvarez says the figure is arbitrary. Each traffic highway would need 100 triply coincident signal locations—one for each half mile of the 50-mile stretch being scanned. If there were two outgoing and two incoming highways, that would mean 400 locations. That extra hundred is a "barrier lane" separating opposing traffic, like the white line on the motorist's highway.

That's only the start of Tricon. Now for the gimmick: the system has separate command and control channels. In addition, each airplane using a Tricon airway would be equipped with an automatic "annunciator" radio transmitter. After all, the folks at selected intermediate stations on the ground want to keep track of the planes in the air.

Pointer (right) gives pilot positive indication that he is on or off course. This dial can be used both for navigation and blind landings. Electric computer "brain" keeps pilot on parallel course (below) which is offset from beam transmitted by ODR.



OFFSET DISTANCE

DME dial (right) gives pilot progressive messages on his distance from destination. Signal from DME is "bounced" and travel time measured.



B-D (bearing-distance) computer navigation can set up any number of parallel courses at any altitudes. At take-off plane proceeds to pre-selected lane, then turns to fly straight-line course to vicinity of destination. There it again changes course to arrive over airport. Pilot

needs to set only three dials on computer before take-off. Errors in resulting readings average less than 1%. The computer is the first instrument of its kind to be actually installed in a plane and flown experimentally. Course offset allows for windage and other variables.

They also want to give them orders. So the annunciators would keep sending signals to the ground, and receiving equipment there would keep tab on every plane aloft.

Identification, position, course, altitude, and speed would be automatically recorded. This, in effect, would provide the counterpart of railroading's automatic block signals. Every aircraft would get a flasher signal from traffic control on the ground if it was getting too close to the tail of the plane in front of it, another signal if the plane behind was getting too close to its tail.

It may sound like a third piece of pie after a turkey dinner, but the sponsors of Tricon add that the whole system can be fed into the cockpit autopilot.

Tricon's shortcoming is not one of technical obstacles. Dr. Alvarez says it can be done. What may hold up inauguration of the system or cause outright abandonment of the idea is the expense of its installation.

The heavily traveled New York-Chicago direct airway is a case in point. Today it is served by 17 radio-beam stations. Tricon would replace them with no less than 42 master-and-slave stations, plus a number of stand-by transmitters for use if anything got out of kilter.

As yet, Tricon is only on the drafting board.

The other system for more accurate navigation, using Minneapolis-Honeywell's B-D Computer, not only is far simpler, but it has a running start on Tricon. The computer is in experimental use and has been recommended for adoption by the international airline trade association, ICAO.

It is a combination of an electric brain and a bird dog. The brain figures out the answers from all the variables—winds, distance, route, and aircraft speed—and the dog points where to go. The B-D will not do everything Tricon proposes to do. It

won't keep ground stations posted as to the positions, courses, and altitudes of planes in the air. It won't flash red lights if there is danger of collision.

But the company originating it says it will raise today's "one-lane country roads" aloft to the status of 10-lane superhighways. Like Tricon, it will provide aircraft with a large number of flight paths on any given airway. That means added safety. Moreover it can be adapted to automatic landings.

B-D Computer operation requires three elements—the computer itself, a series of omnidirectional radio beacon stations (ODR), and distance-measuring radio transmitters (DME). ODR stations are now being set up by the government.

Can Set Up Hundreds of Airways

ODR differs from the conventional radio beam, emitting "A" and "N" Morse signals to keep a plane on course, in that it sprays a direction-indicating signal out to every point of the compass. Ordinary radio beams provide four airways, no more. ODR could provide hundreds, if necessary. Its freely scattered signal could be only confusing if it were not combined with a cockpit dial and needle pointing unerringly at the transmitting station. A pilot needs only to tune in the proper frequency. The needle says, "There's where you're going."

The needle gives him a line of position. He knows he is on the right road. What he doesn't know is how far along the road he may have come since taking off. So DME, issuing from a ground station too, is introduced. DME is only a variation of war-time's Shoran (PS, Aug. '46, p. 128). DME tells a pilot how far he is from a radio transmitting station. If he already knows he is on the right road, he has all the information he needs.

The beauty of the B-D Computer is that a dispatcher at an airport can send large numbers of airplanes separately down parallel lanes to the same destination. Planes can fly "off course" and remain on course.

A pilot figures his winds, altitude, and the course he has been told to follow before he enters his cockpit. These facts he feeds into the computer. If he is to fly 15 miles off to one side of a straight line between take-off and destination, he turns some knobs and loads the responsibility on the computer.

Then he feeds juice into the device. Instantly it begins digesting two signals—one from ODR and the other from DME. One signal gives him the compass bearing, the other the distance. A pilot can fly by watching the needle on his dial, manipulating his controls to keep it centered, or if he likes he can feed the computer's answers into the autopilot and sit back with the funny papers.

The plane will hold its track right up to its destination, turning from "off course" to "on course" at the proper moment. The computer takes head winds, cross winds, and tail winds in stride, and will switch from one ODR station to the next automatically.

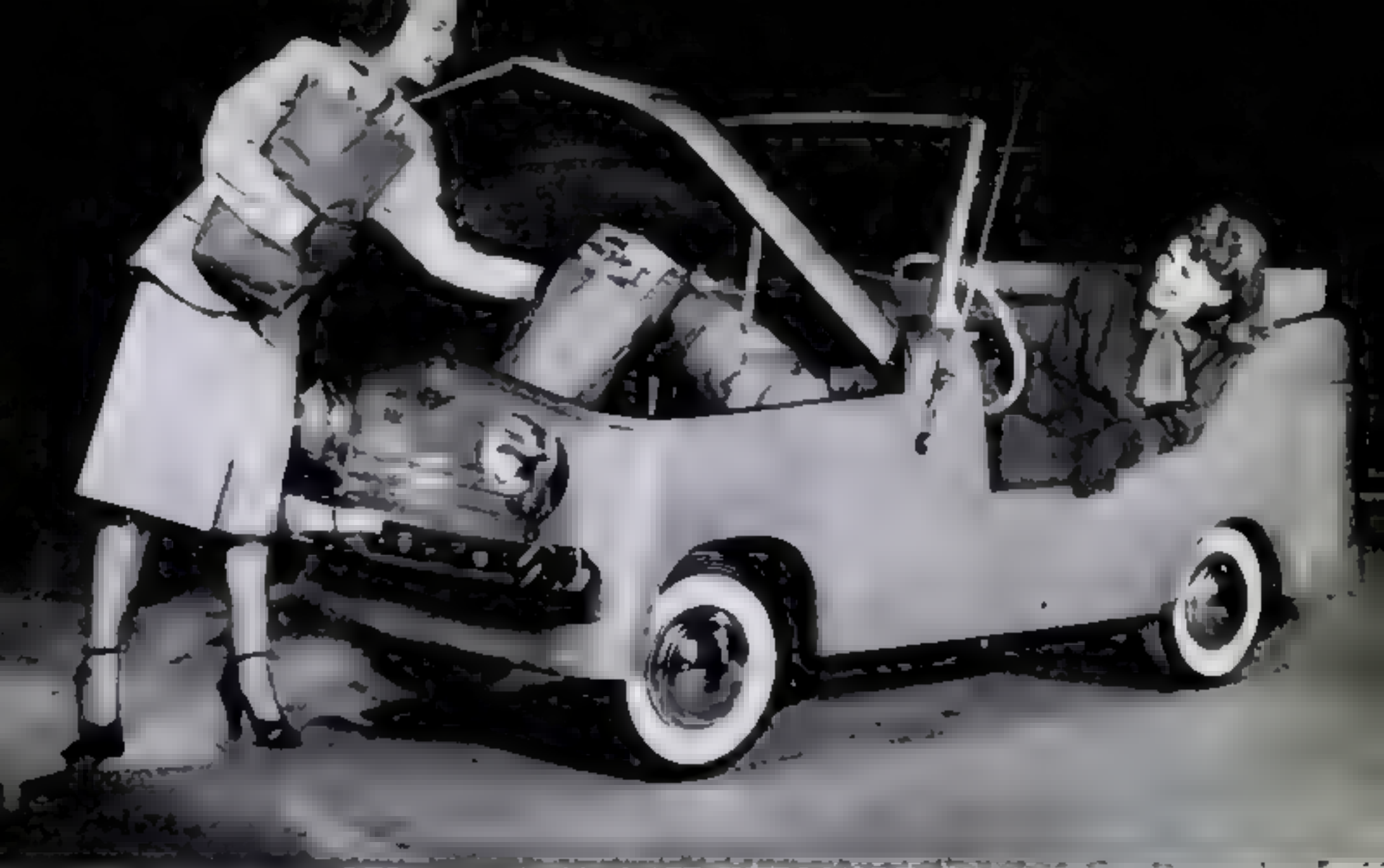
It can be made to do other tricks. It will work a dial giving a pilot his estimated time of arrival at an airport. If he is advised in flight to slow down and come in for a landing 25 minutes later to avoid "stucking," he can consult the computer for the airspeed he should maintain to meet the new schedule. And, ODR, unlike the radio-beam system now in use, isn't affected by static.

The B-D Computer system, too, supplies a third piece of pie on top of the turkey. Just throw a switch. That feeds ILS (Instrument Landing System) signals into the autopilot in place of the ODR signals, and the plane proceeds to land itself. **END**

Picks Up, Melts Snow

This track-riding monster picks snow up and melts it to clear big railroad terminals. Pronged teeth on the spiral sweepers in front whip the snow from the tracks to a pair of conveyer belts, which carry it to a 16,000-gallon tank (behind the conveyers in photo) for melting. When full, the tank dumps the water through two 14-inch valves. The 100-ton snowmelter is in use at the Canadian National Railways' Montreal Terminal.





For package-laden shoppers, an outside foot release opens up the roomy trunk in the nose of

this 116-inch-long, 50-inch-high midget convertible. Top is folded above engine in the rear

Tiny Car Does Big Job

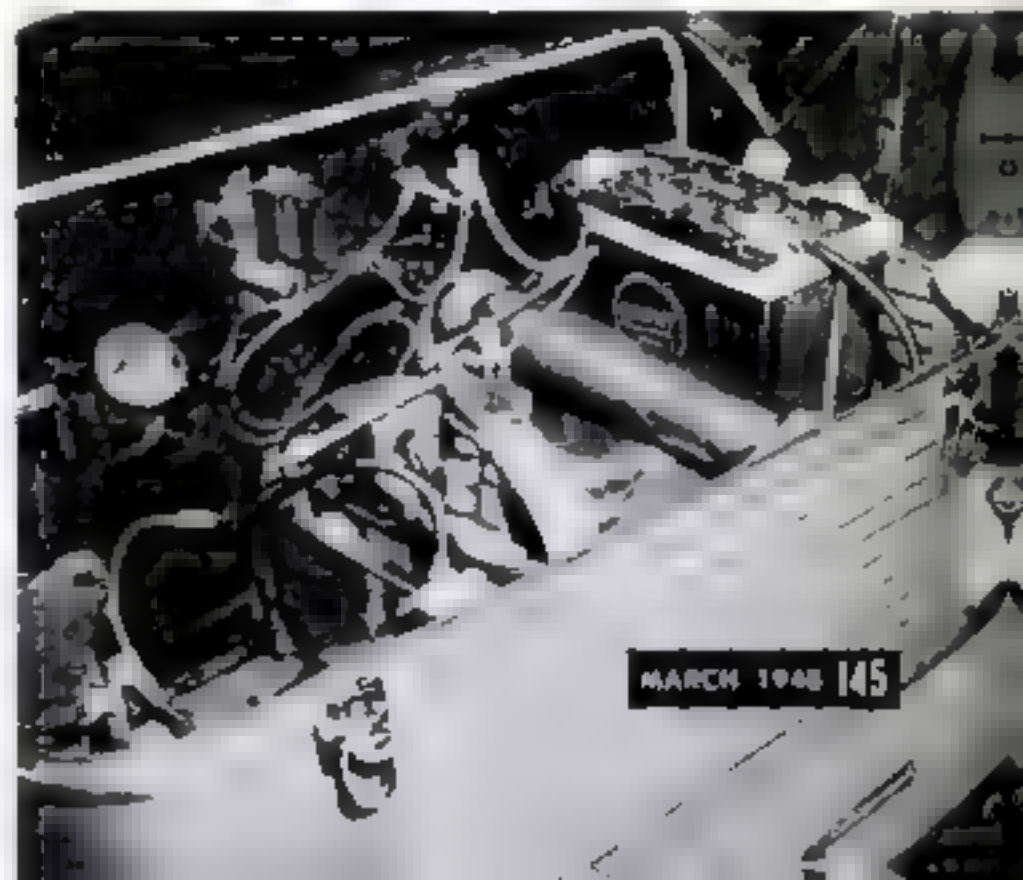
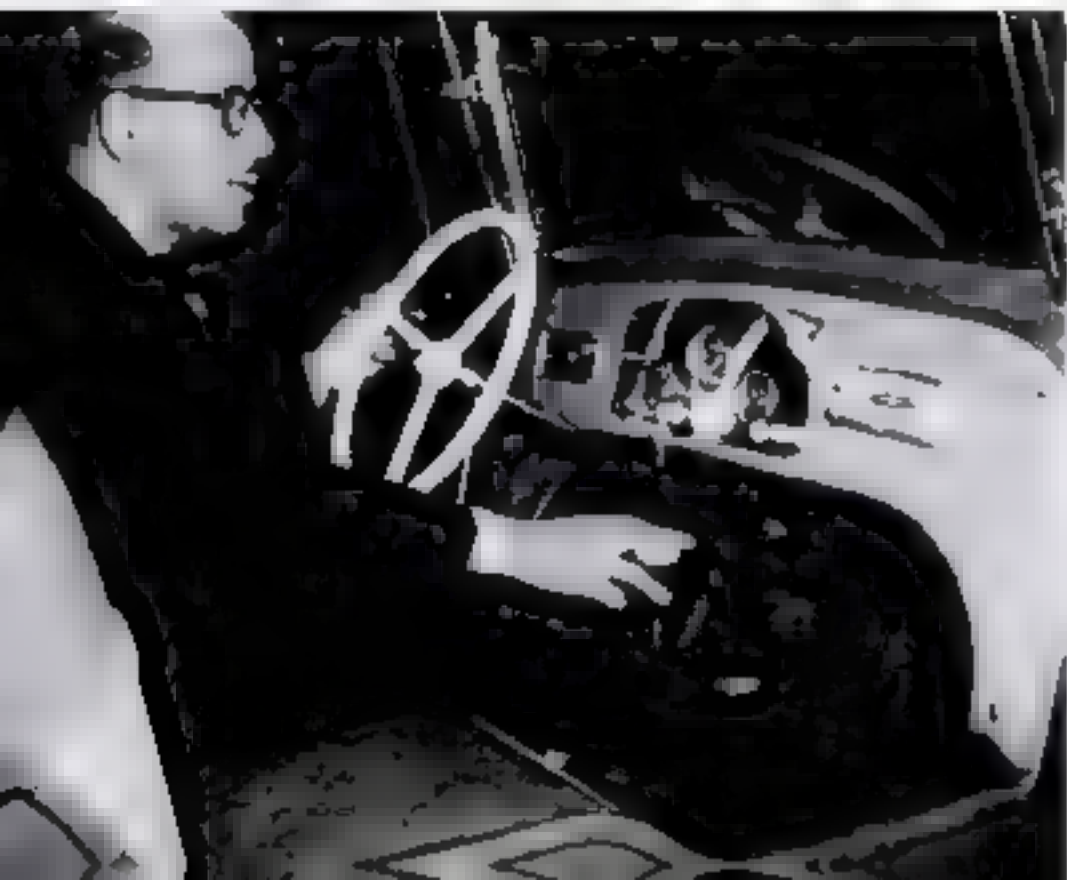
ONE answer to a shopper's prayers is this miniature, two-person convertible, called the Towne Shopper, soon to be produced by the newly formed International Motor Car Co. Designed for economy, it is priced at \$595 f.o.b. San Diego and promises 45 to 50 miles to the gallon at speeds up to 50 m.p.h.

Made largely of aluminum, the flashy

little coupe weighs only 800 pounds, is less than 10 feet long, providing easy maneuverability. The compact two-cylinder Onan engine, squeezed under the stub hood in the rear, leaves the larger space in the front for storing groceries or baggage. Whitewall tires, a radio with aerial, and a folding top add the luxury touch.

Broad seat accommodates two, while smart dashboard keeps instruments and controls to a minimum. Despite simplicity, car has automatic clutch with two speeds forward, one reverse.

The opposed-cylinder, 10.6-hp., air-cooled engine is housed in the rear. Unique flywheel combines generator and starter in single unit. Aluminum cylinders have iron sleeves for longer wear.





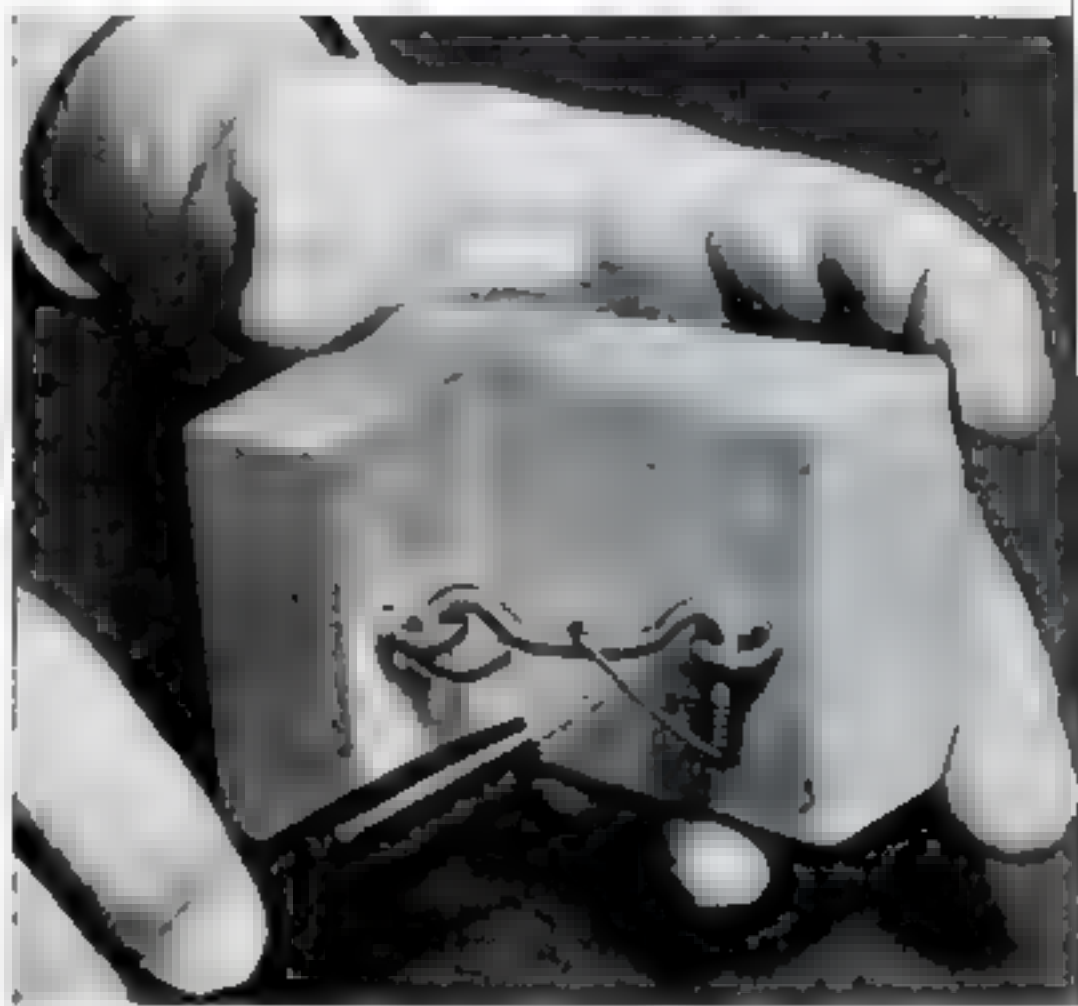
Gadget

**By Andrew
R. Boone**

Youngsters can learn the rudiments of flying on this junior edition of the famed Link Trainer. Miniature stick and rudder bar make model airplane climb, bank, and dive like a real one.

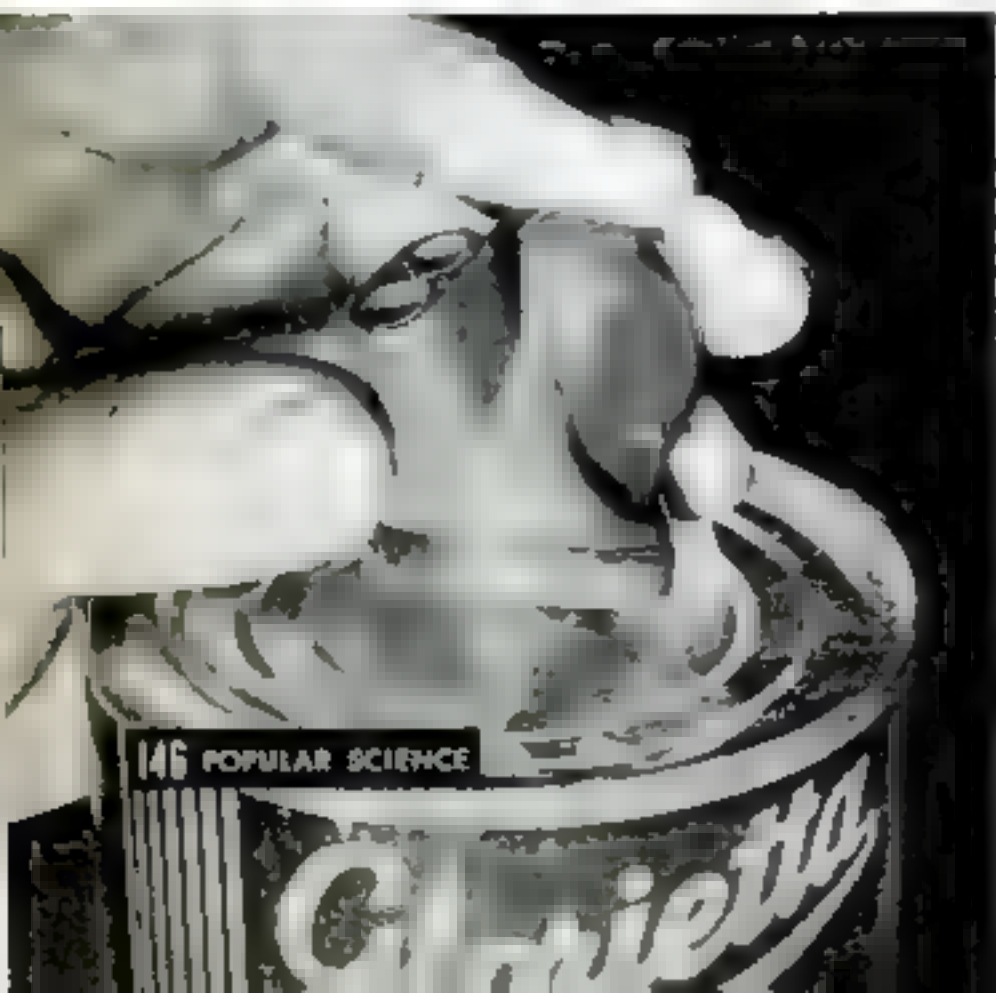


There's less chance of upsetting drinks and ash trays, not to mention added leg room, with this legless bridge table. The four chairs that support it swing outward for easy accessibility.



No burglar can unhook a screen door or window when this tiny coil stands guard. With one end looped around the hook's shaft, the coil can't slip off and keeps the hook from being raised.

No-hurble pouring is the boast of this twin-hole can spout. One hole pours liquid, while other lets in air. Its spearlike base is punched into can's top, and a quarter turn locks it in.



If the phone rings or baby calls, you don't have to set your stirring spoon down on the clean stove. Just slip it into the side of this coil clipped to the pot's rim, and there it will stay.



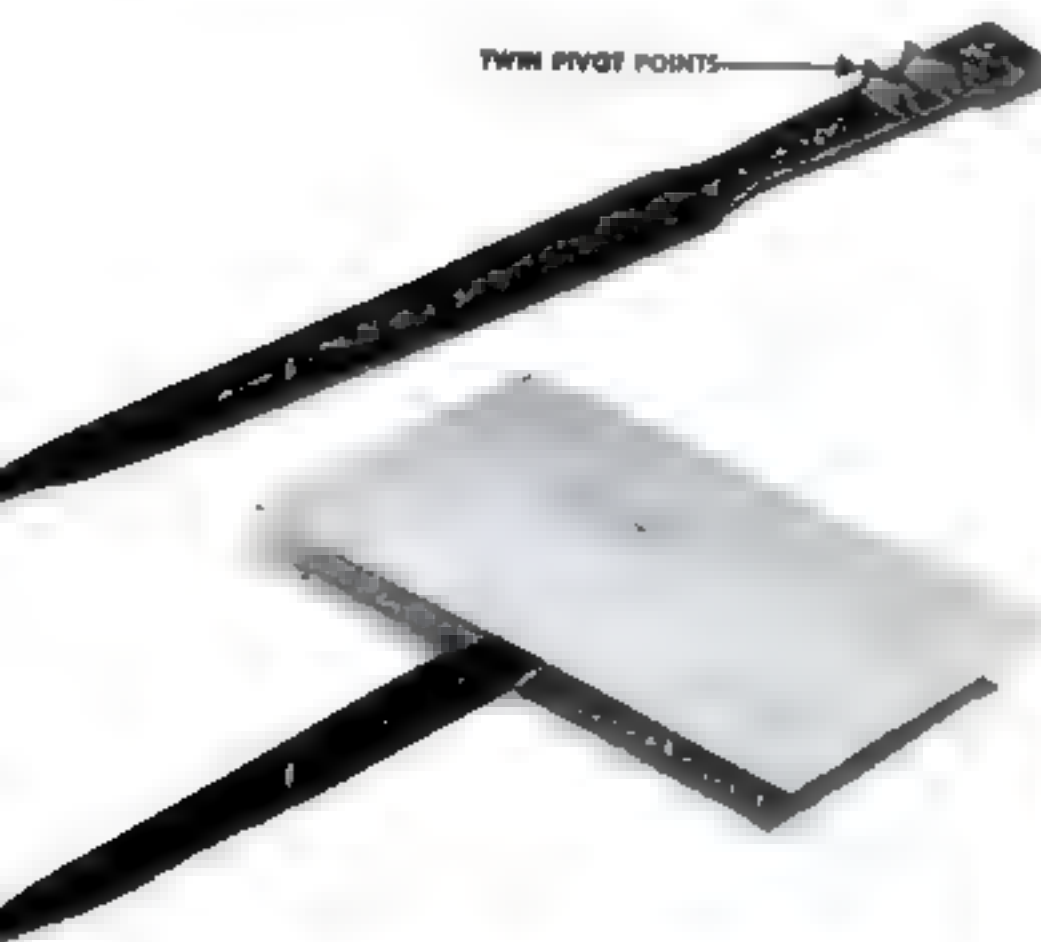
Grab Bag

MORE than 400,000 Americans are shelling out from one to five dollars apiece to dip their hands into a monthly, mail-order grab bag. What will come out each month no one knows until the wrapping is off. All they know is that it will be some gadget representing the latest mechanical effort to

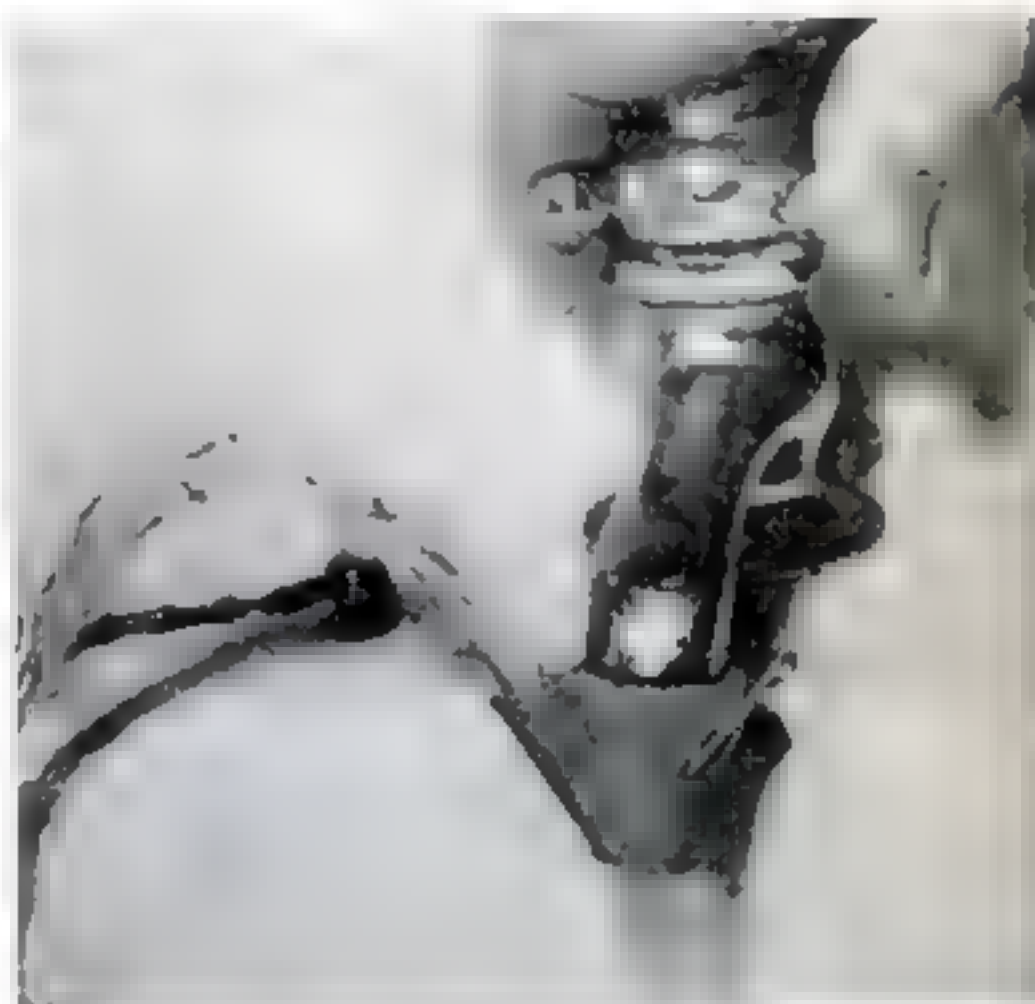
make life a little easier, safer, or more fun.

What they get depends on whether they have sent in \$1.00 for a six-month trial or \$5.00 for a year's subscription to a dozen bigger and better gadgets. It may be a comb with a removable wick in its base, a powder fire extinguisher that doesn't deteriorate, or a window-sash burglar alarm.

The gadgets are selected and distributed by the Gadget-of-the-Month Club, Los Angeles, Calif. Anyone can submit an item

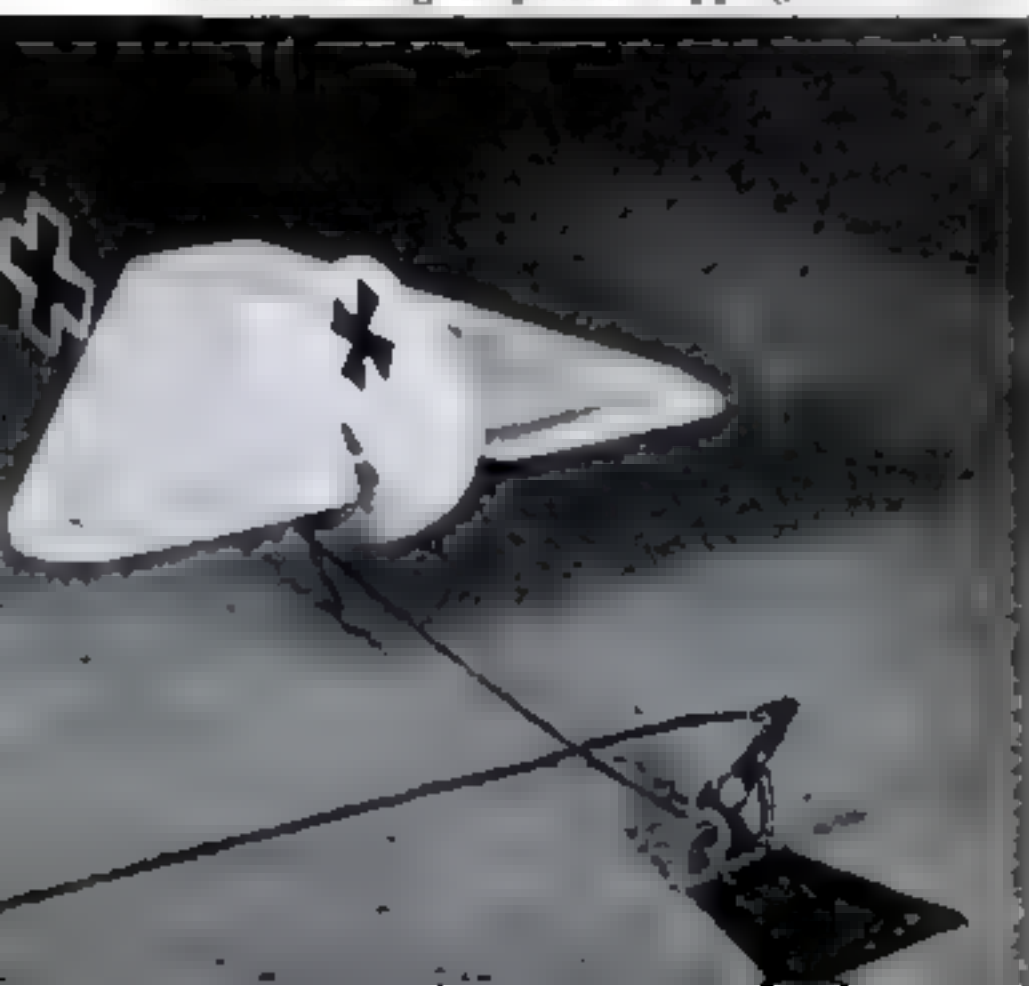


This letter opener also weighs mail. Balancing on twin pivots, it stays tilted down if letter is ounce or less, raises to horizontal if between one and two, tilts up if more than two.

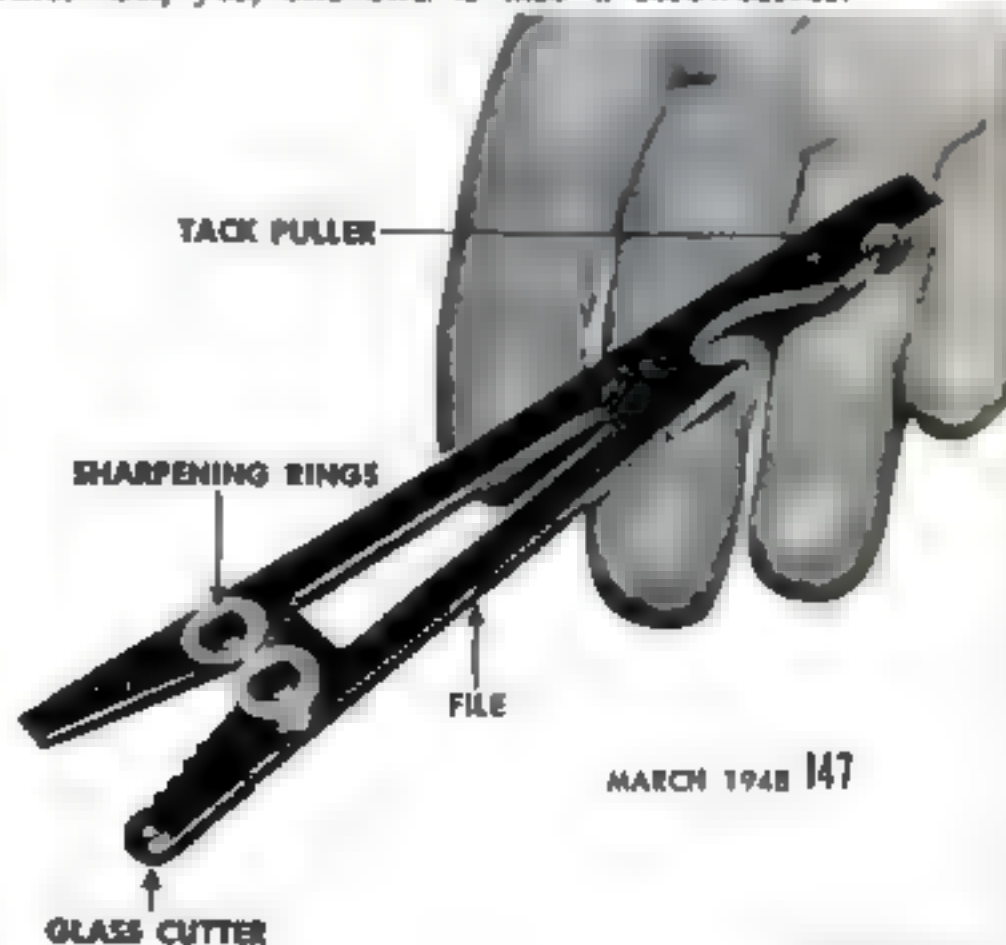


This little rubber spout turns an ordinary faucet into a drinking fountain. Pulling up the wire handle partially closes a valve that sends some of the water arcing out of the spout.

Model planes can get off to a good start with this mechanical starting release. Holding the plane until its engine warms up, it lets it go when a string is pulled tripping the release.



This handy, many-in-one tool pulls tacks, cuts glass, sharpens knives, and takes caps off bottles. One edge is a file, the other a four-inch rule. Oh, yes, one end is also a screwdriver.



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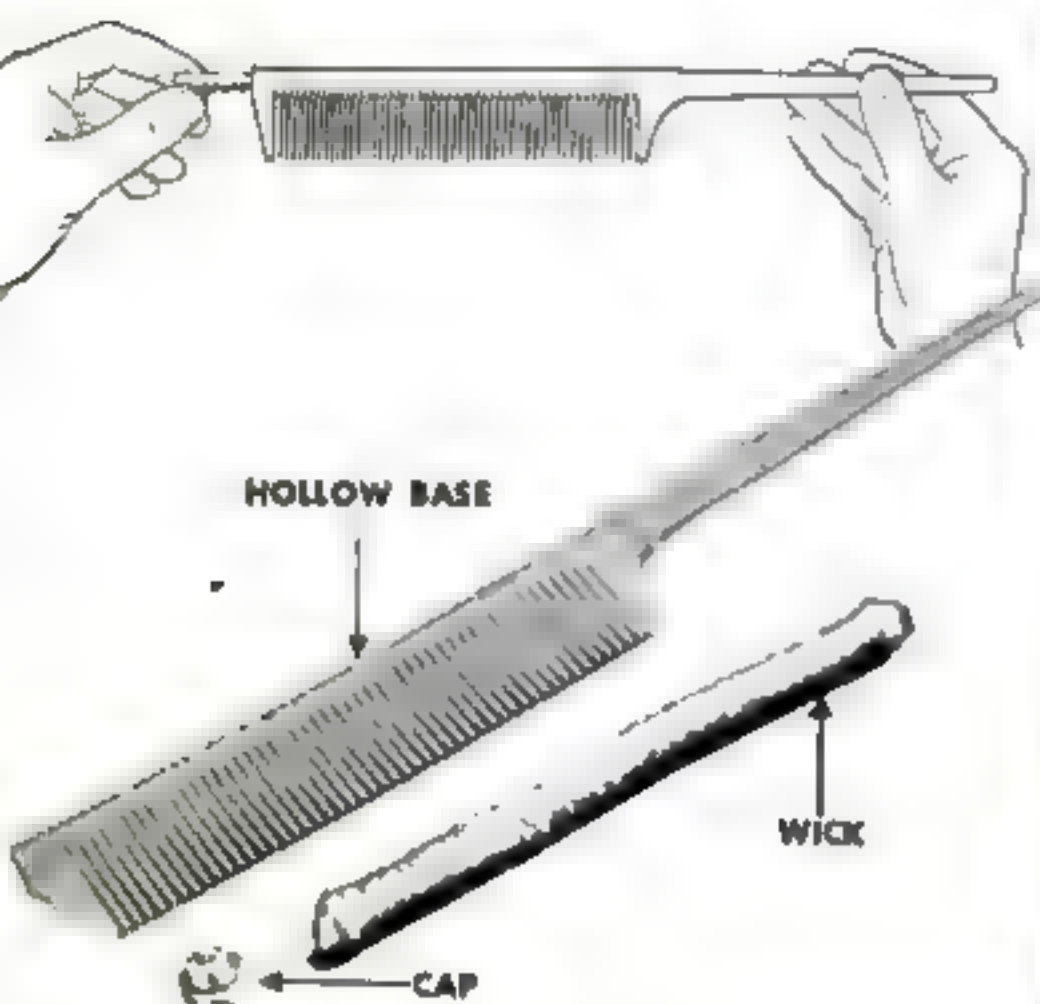
for distribution. There are only three requirements: it must be new, must be patented or patent-applied-for, and must never have been distributed nationally. A jury screens out the best bets, which are then sampled by 15,000 members of the Consumers' Testing League. Those approved by at least 10,000 members are picked for distribution.

The same gadget, however, is never distributed to the full list of subscribers, since

the men would hardly go for kitchen gimmicks, and the ladies could not be expected to rave about a razor guaranteed to shave under the nose.

Many of the larger gadgets, of course, some of which are shown here, are too high-priced for the regular subscriptions. These are made available at special prices to club members and later put in retail stores.

Like other monthly "clubs," this is really a merchandising plan. Unlike others, how-



To clean the crannies of this comb, you simply remove the wick in its base and insert a fresh one. Resembling a pipe cleaner, the wick can also be used to comb perfume through the hair.



Blades are quickly picked up from smooth porcelain when touched with the handle of this magnetic razor. Its curved head and goose neck also permit easier shaving of facial hollows.

When you hear this bell, it's not Johnny's bike but someone trying to climb in a window. A furtive tug at the sash sounds the alarm; a violent one, and the device jams the window.



This gadget will crack a nut, squeeze an orange, or grapple an ice cube. For fruit juice, the concave pan is screwed onto the set screw. The arms that form the handle provide tongs.

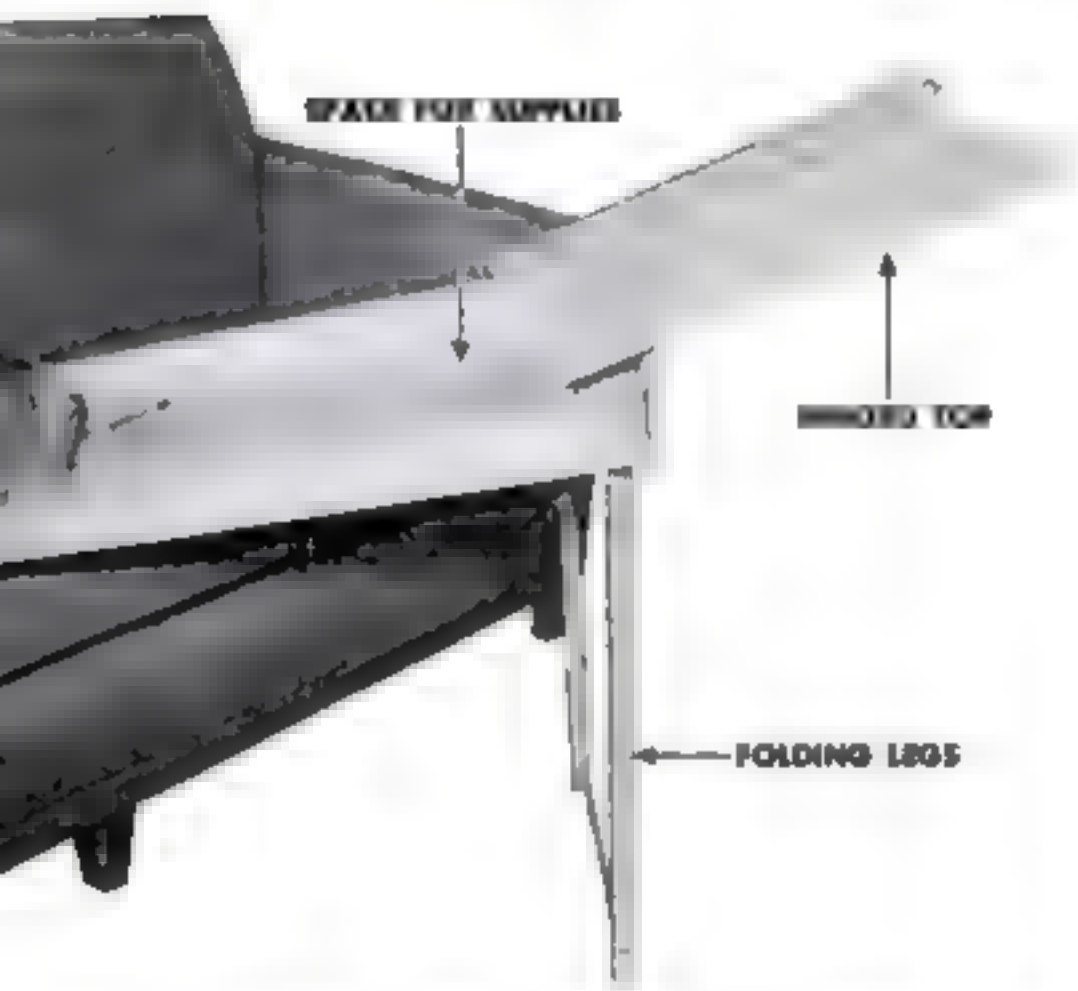


ever, the customer buys blind. The club is also unique in giving inventors an opportunity to develop their brain children for direct introduction to consumers prior to public sale. The club appraises items without charge, suggests possible manufacturers, and itself finances many found worthy.

Springing from the desire of 23 manufacturers to find customers for war-developed items, the club was organized in 1943. Now the National Inventors Assn. and the

National Gadgets Mfg. Assn. are joining with the club to stage a National Gadget Week late in April. They plan to establish a community in California called "Gadgetville," where inventors can live and perfect their ideas. In addition, "gadget nooks" will be placed in retail stores across the nation, with a new item featured every week. The nation will become more gadget-conscious than ever if these enterprising gadgeteers have their way.

END

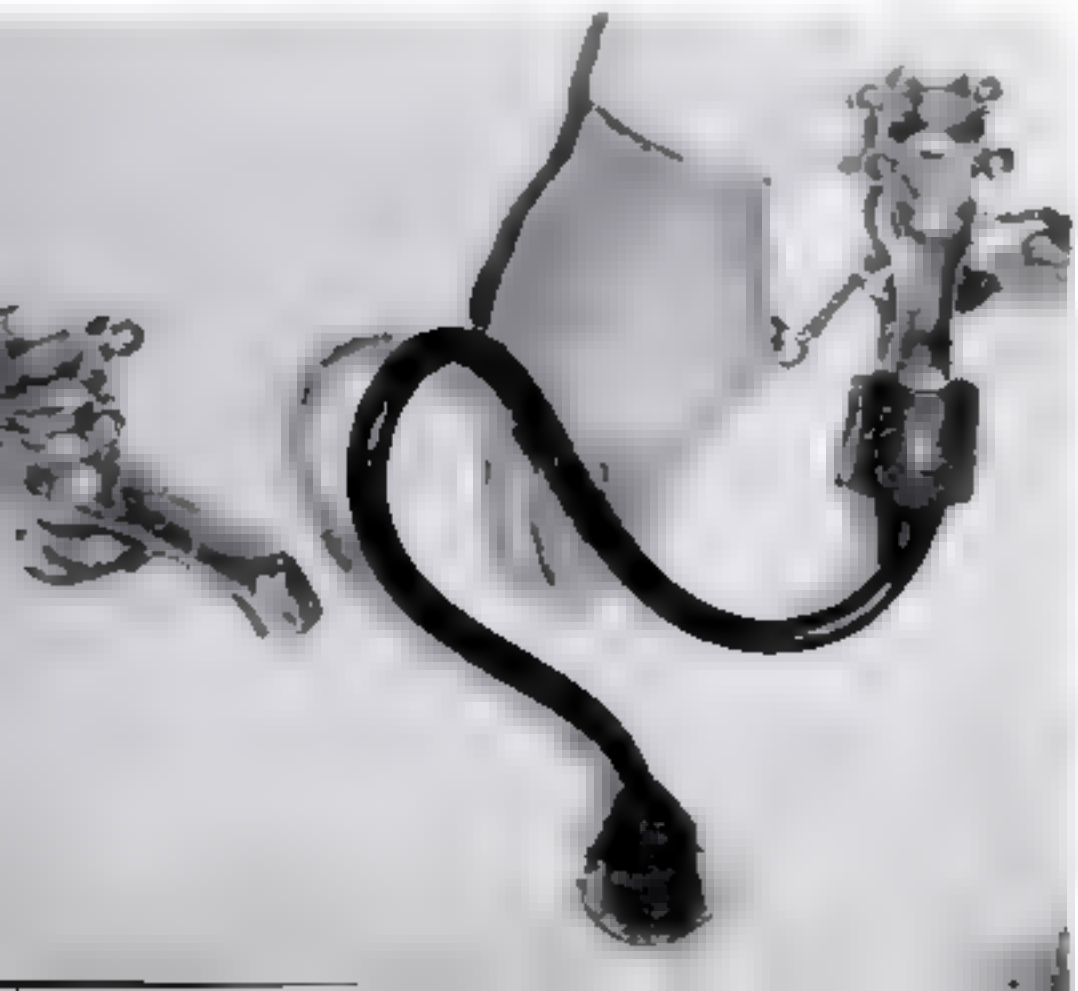


Wherever there's a seat, this portable, folding desk can go into action. Just let down the two legs in front and rest the back on your lap. Under hinged top is space for supplies.



Made of plastic, this small fire extinguisher never goes stale. Instead of liquid, it contains a powder that smothers flames with carbon dioxide. Powder is guaranteed to last a lifetime.

It's only a short rubber hose, but with one end on the faucet and the other wedged down a clogged sink drain, it forces water into the drain at nearly pipe pressure to help clear it.



Here's an orange peeler that doesn't spoil the juicy parts. A circular cut is first made with the handle's edge; then the long, curved wire, slipped underneath, easily strips off the skin.





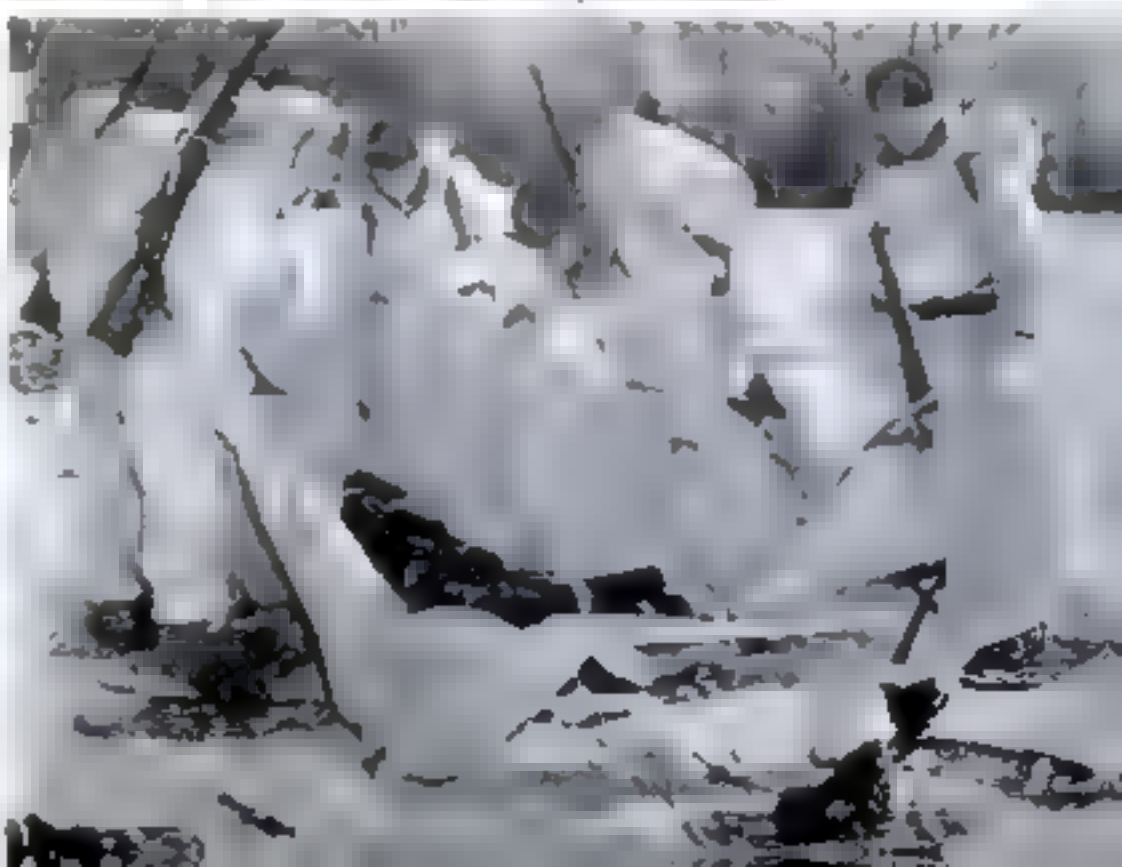
1 When Sgt. F. G. Brown, one of the winterized paratroopers of the 505th Airborne Battalion Combat Team, poses himself for a combat jump, every conceivable piece of gear is close to

340 lbs.—about double his normal weight. During Exercise Snowdrop at Pine Camp, N.Y., this past winter, members of the 505th learned all weather combat operations.

4 The second equipment bundle contains ammunition for the mortar. Both bundles must be retrieved and repacked quickly. Paratroopers in these photos are wearing snowshoes.

5 All equipment is packed on the sled so that it can be loaded to the helicopter. Besides carrying how to ski on snowshoes, the men of the 505th had to learn how to pack.

158 POPULAR SCIENCE



He's a Flying Snowshooter

The parka-clad paratrooper is a new kind of soldier. He can jump in a blizzard and fight in a freeze.

By George H. Waltz, Jr.

PS photos by W. W. Morris

SGT. F. G. Brown is one of a new kind of soldier in Uncle Sam's Army. Besides being a crack air-delivered infantryman, he now is winterized and has added a good many new cold-weather fighting tricks to

his already full bag of military know-how.

"Brownie" is a member of the 505th Airborne Battalion Combat Team with whom I shivered for several days this past winter. Up at Pine Camp, near Watertown, N. Y., he and the rest of the 505th were testing themselves, their weapons and their equipment, and their ground tactics, under rugged sub-freezing combat conditions. The three-month-long maneuver, known as Exercise Snowdrop, was a continuation of previous cold-weather operations Frigid,



2 After a paratrooper hits the snow, his first job is to get out of his gear as quickly as he can. In a well-timed jump, troops and cargo 'chutes will land close together.

6 The mortar squad is packed and ready to trek. Men replace sled dogs on most paratroop combat missions. The three men pulling the sled are wearing special canvas harnesses.



3 A mortar squad like the one Sgt. Brown commands is serviced by two equipment bundles. The one shown above contains an 81-mm. mortar, sled, and an easily assembled sled.

7 Set up and ready to fire. The men work with split-second teamwork. A crack crew can assemble a 75-mm. howitzer and have it ready for firing in less than seven minutes.



Frost, and Willwaw. Unlike these three previous general operations, however, Exercise Snowdrop was designed principally to test the use of airborne troops and the tactical planning peculiar to large-scale airborne operations.

Basically, Sergeant Brown, like a good many of his mates, is a paratrooper, a job he learned to put to good use in World War II. But during Exercise Snowdrop, he had to learn to ski, snowshoe, pack a sled, keep warm, care for his equipment and weapons in freezing weather, and to apply his fighting tactics to terrain covered with ice and snow. All this in addition to keeping his hand in at his basic trade—parachuting to the ground with his full load of combat gear.

Being a paratrooper under ordinary combat conditions is no job for a softy, and in cold weather, freezing winds, and snow it's twice as tough. Take Sergeant Brown as an example: dressed in his ordinary, indoor uniform, "Brownie" tips the scales at about 165. But for a winter combat jump he is dressed in 35 lb. of special cold-weather clothing and wears 40 lb. of parachutes (a main back pack and a reserve chest pack). Add a 60-lb. rucksack, plus snowshoes and other odds and ends of weapons and equipment. Now he weighs close to 310 lb.—just about twice his normal weight—as he snaps his parachute static line on the overhead anchor line and waddles up to the jump door of his transport plane.

Two-a-Second Bail Out

Yet, even though hampered by that much bulky gear, he and his combat jump mates can bail out of their low-flying plane at the rate of two men every second. Three planes dropping full complements of men and equipment can saturate the air over a "drop zone" (paratroopers call it the DZ) with parachuting men and weapons.

During Exercise Snowdrop, the 505th used Fairchild C-82 Packets flown by Troop Carrier Command personnel. Lugging 42 paratroopers and their equipment, the C-82 is well suited to airborne operations. Twin jump doors at the rear of its fuselage allow two parallel lines of paratroopers to walk off the plane simultaneously.

Another feature, a special electric mono-rail method of handling the equipment sent down with the men, drops as many as 15 bundles or "paracans" automatically through its bomb-bay doors in eight seconds (PS, July '47, p. 111). The 14 paracans required



Sgt. Brown and the gear he wears for a winter jump. Ordinarily he tips the scales at about 165. Here he has already added 1 lb. 8 oz., in the form of 3 pairs of ski socks and a heavy underwear shirt, to his basic uniform of cotton underwear, shirt, pants, and web belt.



Two main essentials to a paratrooper—his main back pack parachute and his reserve chest pack parachute—add another 40 lb. The back pack alone weighs 28 lb.; the chest pack 12 lb. The back pack is opened by a static line that the sergeant attaches to an anchor line in the transport plane before he jumps.



2. PLUS 8 LB., 5 OZ.

"Brownie's" weight builds up fast as he gets dressed for frigid jump weather. In this photo he has added his combat pants (1 lb. 8 oz.), ski boots (8 lb. 2 oz.), and is lacing up one of his ski gaiters (the pair weighs 11 oz.). The ski boots also double as mountain shoes.



3. PLUS 7 LB.

A combat jacket, white reversible parka, and white ski pants add another 7 lb. So far Brownie's weight has been boosted 16 lb. 13 oz., and he still has a long way to go. In the photo sequence starting at left below, he puts on weight in really big chunks.



5. PLUS 13 LB.

No fighter is complete without his personal weapons. Here Brownie is shown fastening in place his Garand rifle contained in a Griswold pack, weighing 9 lb. His pistol, belt, and holster weigh still another 4 lb. A winterized paratrooper can carry his ammunition either in bandoleers or stowed in his rucksack.



6. TOTAL: 307 LB., 5 OZ.

After putting on another 72 lb. 8 oz., Brownie is ready for a snow-country combat jump. The rucksack that he wears in front strapped around his waist adds 46 lb. 8 oz. It contains, besides his personal gear and clothing, such things as first-aid kit and an axe. The bear-paw snowshoes account for 5 lb. 8 oz. of the total.

for the separate parts of two complete 75-mm. pack howitzers can now be dropped in the time formerly required to drop the parts for one. As a result, weapons and men hit the ground within a small concentrated area at about the same time.

Although snow and cold make the airborne soldier's problem more difficult, they do not change his purpose. The new winterized paratroopers are the advance men—the shock troops—in any over-snow operation. Their job is to land and hold their positions until an airhead can be established and supporting troops can be brought in by glider or transport plane.

When he lands, the snow paratrooper must be equipped to fight and live even though he may not be able to reach an equipment bundle. Beside clothing, rations, and sleeping bag, he must carry snowshoes, a rifle and ammunition, hand grenades, entrenching tools and, depending on the mission, even tank mines. He hits the snow a complete fighting unit capable of protecting and sustaining himself for several days.

In a typical paratroop operation heavy armament in the form of 81-mm. and 60-mm. mortars, 30-cal. air-cooled machine guns, and 75-mm. howitzers is parachuted

to earth along with the men and their bundles of skis and sleds. In a recent test, a complete 105-mm. howitzer plus a jeep—a total load of 13,000 lb.—was successfully parachuted from a single C-82. Even a weasel, one of the Army's best snow-maneuvering vehicles, can be dropped to snowbound paratroopers.

What happens when the first waves of paratroopers have established their positions was illustrated by the final phase of Exercise Snowdrop, just completed. All the supplies and men needed for the building of an airstrip, including landing mats and vest-pocket bulldozers and tractors, were brought in by gliders. Then, when the airstrip was completed, heavy transport planes flew in additional supporting troops. Finally came the bombers, fighter planes, and more C-82s to launch another theoretical steppingstone attack. An airhead had been successfully established.

Uncle Sam's new winterized paratroopers have their peacetime as well as wartime uses. Recently, when an Army C-54 (DC-4) crash-landed near Goose Bay, Labrador, paratrooper medics flew to the rescue in a helicopter-carrying C-82. All six survivors were brought out alive. END

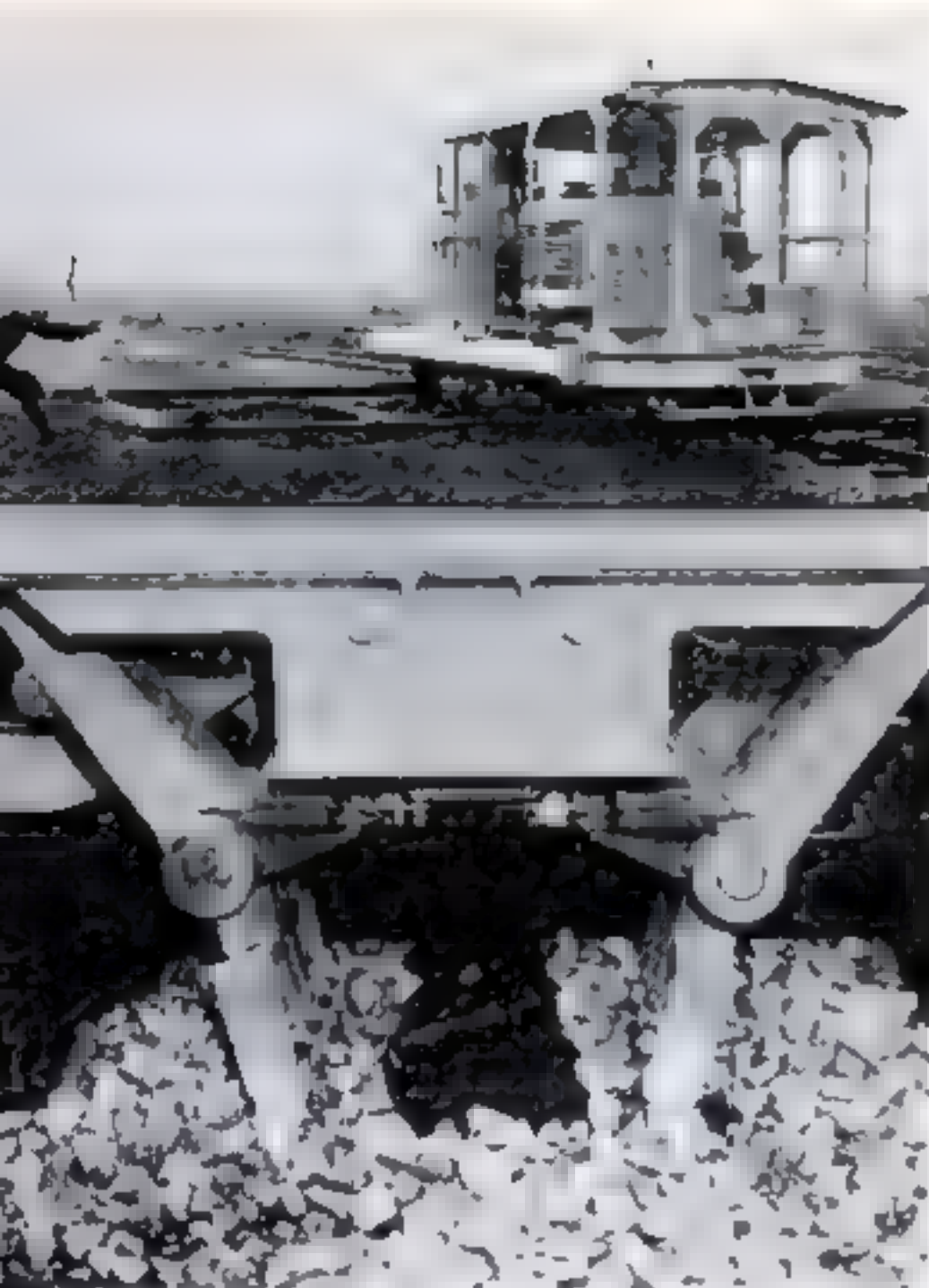
Orchards Get Smokeless Heat

SOUTHERN fruit growers can now fight frost without getting smoke in their eyes. The pall of smoke pouring from ordinary smudge pots and orchard stoves plays no part in protecting the fruit, says Floyd Davis, of Denver, Colo., inventor of the smokeless orchard heater shown at right. So he designed a stove that in eliminating smoke produces more frost-killing heat.

The smoke or smudge produced by most burners is caused by rapid collection of carbon: the longer they burn, the more they smoke. In the Davis burner, on the other hand, the stack is swept free of soot by a continuous blast of air sucked in through holes around the bottom. In one experiment a Davis burner, kept going steadily for almost three months, collected less soot than the average smudge pot would in an hour. What little carbon does collect actually makes it burn better. The final stamp of approval came from Mrs. Fruit Grower. The stove was within 50 feet of an open dining room window, and her curtains didn't need an extra laundering.



Trick of turning smoke into heat is all in the burner unit shown at center, above. With the stack in place, cold air is drawn through the hole in the center of the lower overflow plate. This prevents oil in the burner plate from overheating and vaporizing without proper combustion. Thus most of the smoke is eliminated. The upper overflow plate, acting as a cold-air baffle, keeps the oil from chilling too much.

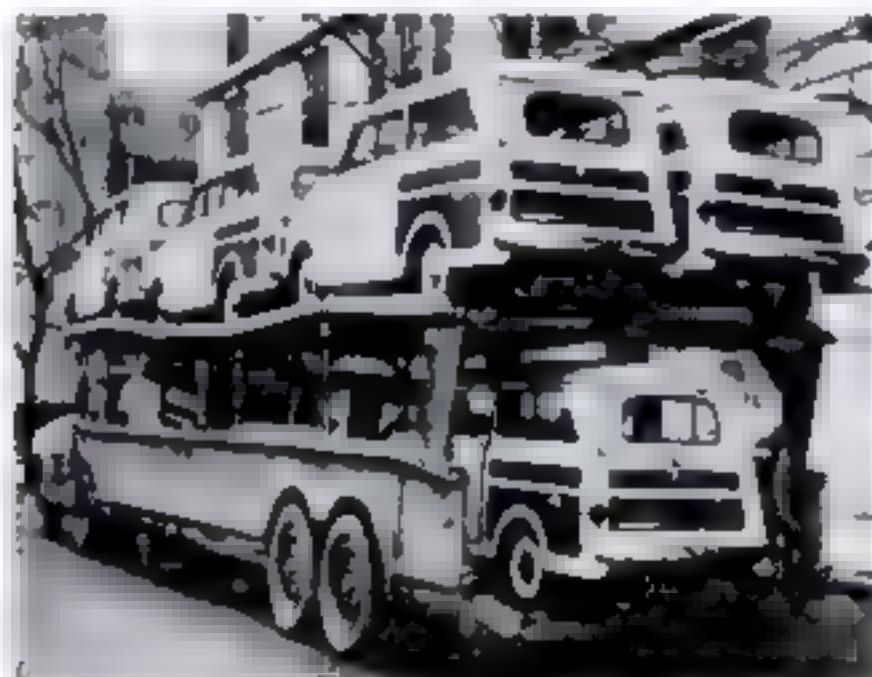


Ties Tamped Tighter

IF YOUR railroad ride is smoother today than it was during the war, thanks may be due this new ballaster (at left, above) that automatically tucks in ties to make for an easier-riding roadbed. Close-up (at left, below) shows how stone, gravel, or cinder ballast is fed from car above and rammed down by two sets of 16 tamping shoes to straighten a crooked tie.

Moving along railroad tracks under its own power, the Pullman-Standard ballaster can cover up to a mile a day, or four times the trackage ballasted by a double crew operating conventional hand-powered tampers. The tamping shoes are attached to a crossbeam that spans the length of the ties. This beam is lifted by a 100-horsepower gasoline motor and dropped with pile-driver action, forcing the ballast underneath the ties.

When a through train whistles its approach, the ballaster car literally lifts itself off the main line. As four compressed-air cylinders hoist the machine off the tracks, side rails are slid under auxiliary wheels located beneath each end of the car, as shown at top. The ballaster then moves sideways, leaving the right-of-way clear.



Auto Delivery Speeded

WITH double parking on top, this new "haulaway" truck loads up with nine Crosley station wagons, three more than was possible with older equipment. Three of the cars ride inside the trailer's steel framework. Six more are stowed in a double row on the upper deck. With delivery a bottleneck, the new auto hauler was developed by Crosley engineers in conjunction with the Kenosha Auto Transit Corporation.



New Spray Fights Mites

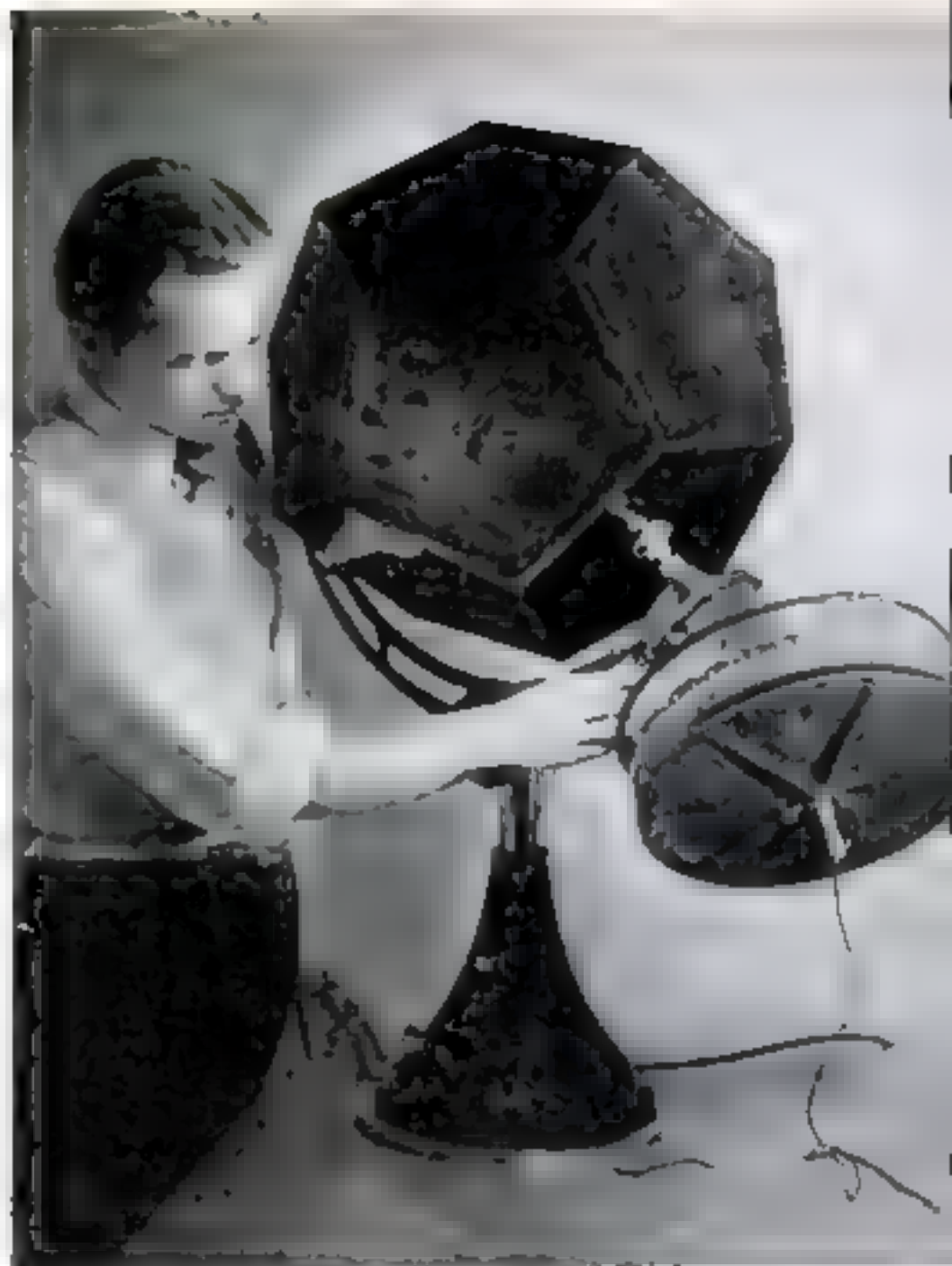
A NEW spraying partner of DDT has been developed by the American Cyanamid Co. When DDT is used on plants and field crops, it kills insects that feed on mites. But then the new insecticide, O, O-diethyl O-p-nitrophenyl thiophosphate (called Thiophos 3422® for short) takes over and kills the mites. Shown above being used experimentally, the new product has proved effective in killing mites on many fruit crops.

\$500 Buys a Real Planetarium

RISING and setting of the sun, moon, planets, and starry constellations are realistically depicted upon the ceiling of a darkened classroom by a half-pint planetarium just placed on the market. It gives the same sort of dramatic show, on only a slightly more modest scale, that costly multi-lensed projectors offer thrilled spectators in the famous planetarium buildings of the world's great museums. These big custom-built projectors, constructed before the war by the Zeiss optical firm for about \$200,000, would cost about \$1,000,000 to build today. In contrast, the new popular-priced model sells for only \$500, bringing it within the reach of schools and amateur astronomers.

Standing only three feet high and weighing less than 25 pounds, the midget planetarium plugs into any AC wall socket. A flick of its light switch, and it paints the room's ceiling with all the stars down to the fourth magnitude—in other words, most of those that the naked eye can see. Throwing another switch turns on an electric motor that sets the stars moving across the field of view, overhead, just as they actually march across the night sky. This effect is heightened by speeding it up; the projector reproduces the changing aspect of the heavens during a twenty-four-hour period in four minutes' time.

The inexpensive planetarium, made by Science Associates, of Philadelphia, resulted from an ingenious lensless and economical design worked out by Armand Spitz, of the Franklin Institute. Its 12-sided star projector, a perfectly satisfactory approximation to the "ideal" shape of a globe, is comparatively simple to manufacture. Rays from an automobile-headlight bulb, within, stream through tiny, accurately positioned holes in opaque plastic panels to form the star images. Holes of various sizes represent stars of different brightness. A drum-shaped projector, on the same motor-driven shaft, similarly forms images of the planets. Simple adjustments preset the instrument to portray the celestial spectacle at any latitude and season.



Any school can now afford to own a planetarium. Miniature type above, inexpensive and scientifically accurate, sells for only \$500. Odd-shaped, 12-sided object is its star projector.



Turning hand wheel, as above, rotates projectors to position for any hour of day or night. Electric drive, behind wheel, runs off the wall, show automatically. Drum at lower right is planet projector, mounted at correct angle to show path of planets in plane of ecliptic.



Miniature planetarium in action realistically reproduces stars of night sky, including the two Dippers at upper right. Images may be thrown on ceiling, wall, or portable dome.

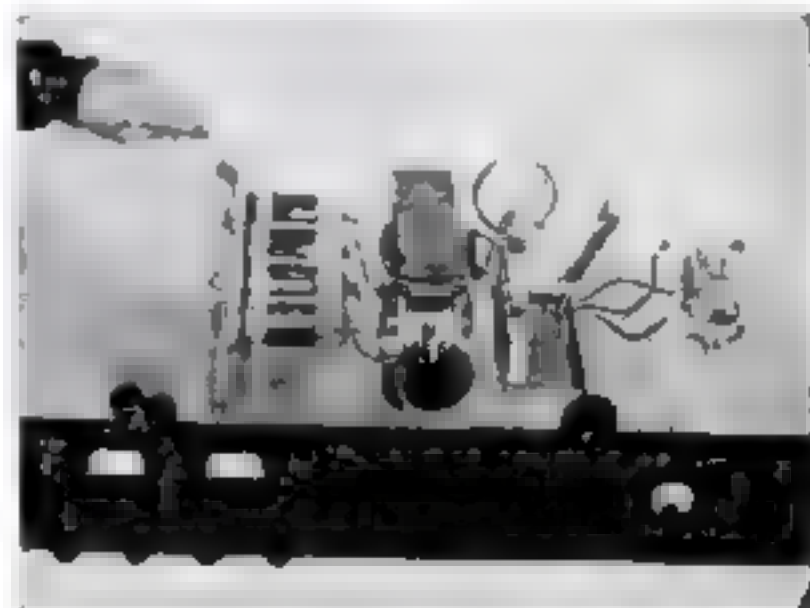


Holes in rims of individual metal rings transmit beams of light from headlamp bulb within, to project the images of the planets. Rings are preset to correct positions, by tabs marked with names of planets, with aid of calendar scale around the drum of the planet projector.



New Microscope

THE Pan-Tec Microscope \oplus above is designed to fill the gap between high-priced instruments and toys. Said to be optically adequate for the most exacting low and medium magnifications, it is equipped with a substage condenser. Two eyepieces and two objectives give a choice of 24, 48, 96, or 192 diameters. Complete, it sells for about \$40.



Sideband for Hams

ABOVE is part of something new in ham radio—a single-sideband transmitter. Usually, the sidebands occupy the space on both sides of a radio signal's carrier wave; eliminate one of them and two stations can operate where only one could before. Previously it was used only commercially, but this simple, new Stanford design can be built by amateurs.



Checking equipment about to be tested under Arctic storm conditions. Before the snow maker is turned on, the test chamber is chilled to remove heat stored in air, walls, and floors.



Live steam (top) is injected into the 40° below blizzard room. The steam forms a supercooled cloud (middle photo). Dry ice is added, crystallization sets in, and snow falls (bottom).

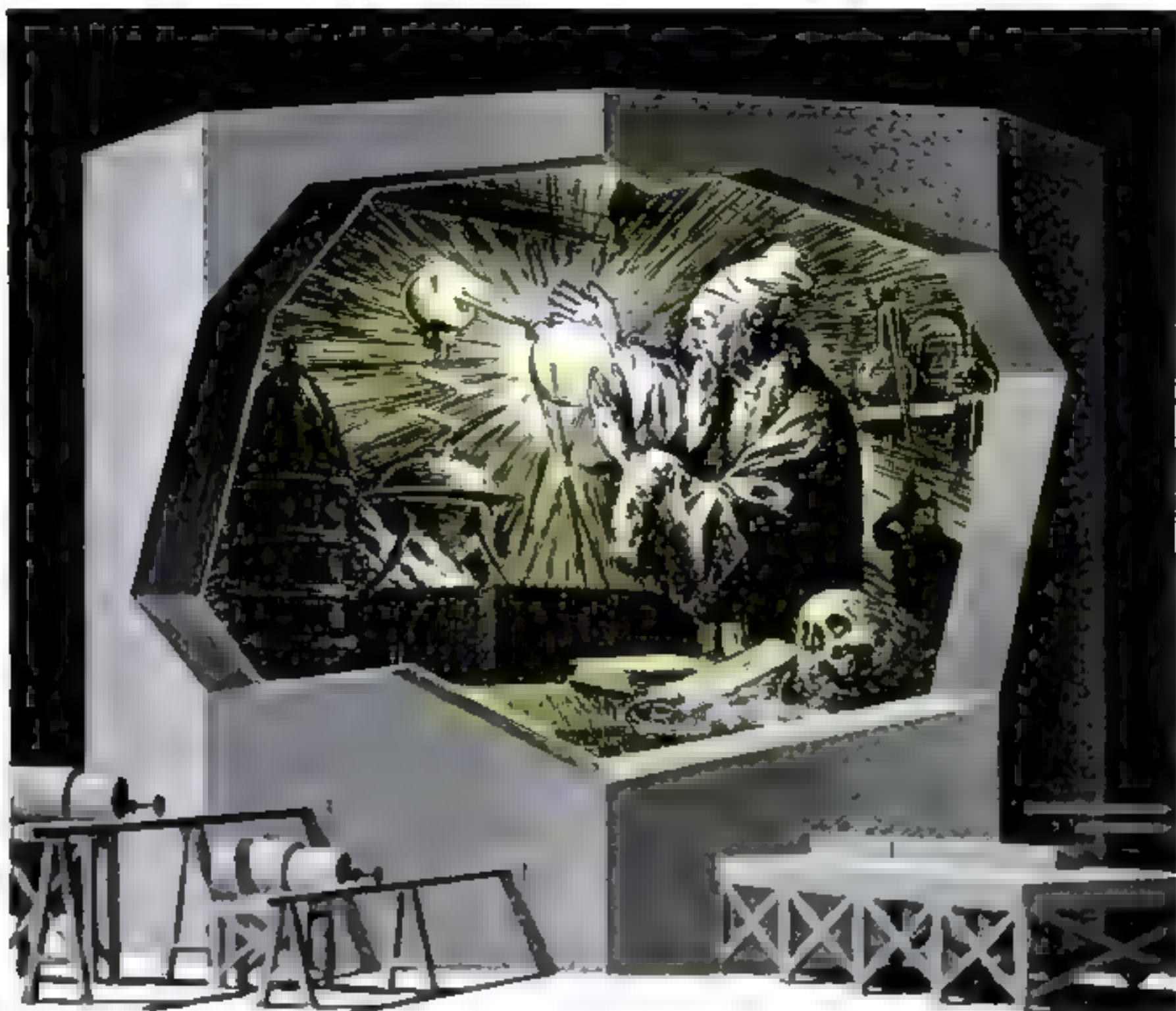
Made-to-Order Blizzard Blows at 40° Below

WHEN Signal Corps test engineers at Fort Monmouth, N. J., say it's going to snow, it's so. They ought to know: they make their own—indoors. These man-made blizzards are whipped up in a new climatic chamber the size of a four-room house, big enough for several observers to watch a variety of signal equipment under test.

Ammonia compressors, powered by more than 700 hp. of electric motors, maintain a constant temperature of 40° below zero in the room. When high-temperature steam is injected, it cools rapidly, forming a supercooled cloud similar to those found in nature. When the cloud reaches about 10° above zero, a tiny bag of dry ice is shaken into it. It continues cooling, and at minus 40°, billions of microscopic snow crystals are formed. Colliding in the moving air, these crystals form small snowflakes. A high-speed propeller creates winds of blizzard velocity. A recent three-day snowfall reached a depth of almost four inches.



After the storm is over, technician dressed in fur-lined parka inspects signal equipment to see how it has weathered the blizzard. It takes at least 36 hours to produce a good snowfall.



Dreams of the ancient alchemists come true in the chain-reacting pile at Oak Ridge, Tenn.

U. S. Alchemists Make Gold

Applying atomic magic to aid medicine and research, radiochemists duplicate nature's elements and create new ones.

By Alden P. Armagnac

Drawings by Ray Ploch

AT Oak Ridge, Tenn., the United States Atomic Energy Commission has gone into the business of manufacturing synthetic gold. The atomic pile is the Philosopher's Stone, long sought by the ancient alchemists, which has the 24-carat touch.

Most curious part of the new enterprise is the odd behavior of the man-made gold. Though locked in the strongest vault, most of it would disappear within a week's time.

Strange to say, this extraordinary way of acting actually enhances the gold's value. What makes it so desirable is the fact that it is radioactive. Hence the ray-emitting "radio-gold" offers medical men a priceless tool for treating such maladies as leukemia, lymphoma and Hodgkin's disease. At one institution alone, Vanderbilt University Medical School in Nashville, Tenn., it has benefited 61 patients in the first year of use.

For therapy and for "tagging" chemicals used in research, Oak Ridge's alchemists—or "radiochemists," as they call themselves—produce scores of artificially radioactive elements like radiogold. But they are by no means limited to "freak" products that have no counterpart in nature.

THE OLD AND THE NEW IN "ELEMENTS"

1. In ancient times, alchemists believed that a drop of water represented the simplest imaginable kind of a substance. Water, they thought, was one of the fundamental and indivisible "elements" of which everything in the world was made.

2. Then chemists discovered that water was a combination of simpler "elements." Taking it apart, they found it to be made up of two dissimilar substances, hydrogen and oxygen, in the proportions indicated by the familiar formula, H_2O .

3. Now 20th Century alchemists find that water actually consists, not merely of two ingredients, but of five! Its "elements," hydrogen and oxygen, turn out to have different varieties or isotopes, shown here with their identifying numbers.



Just as easily, they can manufacture gold of normal behavior, perfectly acceptable to the U. S. Treasury! It may not be the best way to get rich quick—the raw material, as for radiogold, is platinum—but the fact that it has been done illustrates their prowess in transmuting the elements. If future generals and geologists worry no longer about strategic materials and dwindling natural resources because alchemists can make any wanted element from others, it will be hardly more fantastic than what has already been accomplished.

Behind the scientists' amazing feats with cyclotrons and atomic piles lies a new understanding of the make-up of matter.

Chemists once believed that ninety-odd substances such as hydrogen and oxygen, called elements, were the ingredients of every material you could name—air, water, flesh, blood. All the atoms of each element, they thought, were just alike.

Varieties of Elements Discovered

Now the list of the world's ingredients has been multiplied many times by the discovery that these elements have important varieties, called isotopes. More than 700 different isotopes are known today. Those of the same element give the same chemical reactions in a test tube, but they differ in weight and in more spectacular ways. You can safely handle any amount of uranium 238, one of the isotopes of uranium. Merely bring together something less than 220 pounds of another, uranium 235, and its spontaneous explosion will level a city. Some isotopes are stable. Others, even of normally well-behaved elements like iron and sulphur, may turn into something else while your back is turned!

Resembling a gigantic crossword puzzle, a remarkable "isotope chart" recently compiled by Prof. Emilio Segrè, of the University of California, graphically illustrates the new idea of what things are made of. Rows and columns of squares form a pattern ascending diagonally from left to right. Horizontally, the chart ranges in order the 96 elements now known. Vertically, it shows all known isotopes of each element. Some squares even have double entries for "twin" isotopes having the same weight but different radioactive life. Counting these, the 720 filled-in squares have 785 entries in all.

It looks pretty complicated, until you notice the beautifully simple relationship that the new chart reveals. Just two kinds of

NEW CHART OF THE ELEMENTS

This is the way the latest-style diagram begins. Whole chart, to same scale, is five feet long and has 785 entries. They show all known isotopes of the 96 elements and their amazingly simple relationship. All are combinations of only two ingredients, protons and neutrons.

ELEVEN
NEUTRONS
○○○○○○○
○○○

TEN
NEUTRONS
○○○○○○○
○○○

NINE
NEUTRONS
○○○○○○○
○○

EIGHT
NEUTRONS
○○○○○○○
○

SEVEN
NEUTRONS
○○○○○○○

SIX
NEUTRONS
○○○○○○○

FIVE
NEUTRONS
○○○○○

FOUR
NEUTRONS
○○○○○

THREE
NEUTRONS
○○○

TWO
NEUTRONS
○○

ONE
NEUTRON
○

NO
NEUTRONS

HYDROGEN
3

HYDROGEN
2
0.02%

HYDROGEN
1
99.98%

HELIUM
4
99.99 + %

HELIUM
3
TRACE

↑

LITHIUM
7
92.5%

LITHIUM
6
7.5%

↑

BERYLLIUM
9
100%

BERYLLIUM
8
TRACE

↑

BORON
10
81.6%

BORON
11
18.4%

↑

CARBON
12
98.9%

CARBON
13
1.1%

↑

NITROGEN
14
99.62%

NITROGEN
15
0.38%

↑

OXYGEN
16
99.76%

OXYGEN
17
0.04%

↑

OXYGEN
18
0.20%

OXYGEN
19
TRACE*

↑

STABLE ISOTOPES
RADIOACTIVE ISOTOPES
(PERCENTAGES SHOW AMOUNT OF EACH ISOTOPE PRESENT IN THE NATURAL ELEMENT)
* RECENT EXPERIMENTS INDICATE THAT A TRACE OF RADIOACTIVE CARBON 14, CONSTANTLY FORMED FROM ORDINARY NITROGEN 14 BY COSMIC RAYS PENETRATING TO THE EARTH'S SURFACE, IS NORMALLY PRESENT IN THE HUMAN BODY AND IN ALL LIVING MATTER.

ONE
PROTON

TWO
PROTONS

THREE
PROTONS

FOUR
PROTONS

FIVE
PROTONS

SIX
PROTONS

SEVEN
PROTONS

EIGHT
PROTON



Elements long considered laboratory curiosities sometimes meet vital needs. Columbium metal is an example. Used in heat-resisting alloy for

blades of turbine wheel at left, it has made possible the jet engines that drive world's fastest planes like Navy's Skystreak, right.

particles, it shows, make up every one of the 785 varieties and subvarieties of elements. One is the proton, the positively charged core of the hydrogen atom, discovered in 1886. The other is the neutron, an electrically neutral particle, discovered in 1932. These two particles are the true building blocks of the universe.

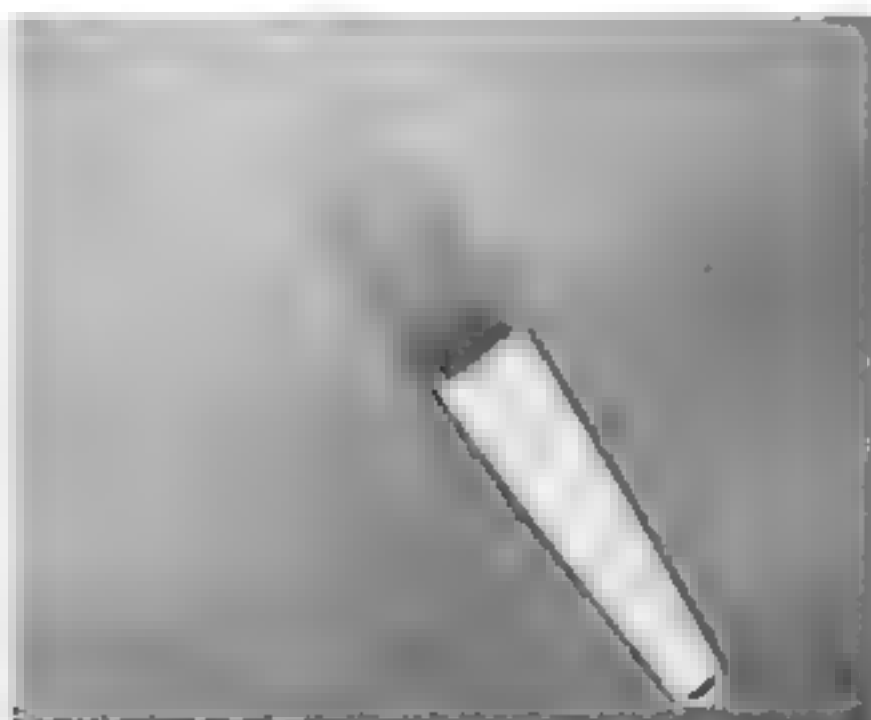
Join the right number of protons and neutrons to make the core or nucleus of an atom—a neat trick if you can do it—and you will have any isotope of any element you want. The number of protons determines what the element will be. One proton makes

hydrogen, two make helium, and so on up to 96 for newly discovered curium. The *total* number of particles, protons plus neutrons, determines what isotope you will get. This is the number, therefore, that you write after the name of an element to identify a particular isotope. It's all as simple as that.

To apply this idea and perform a bit of alchemy, you need only walk near an operating cyclotron with a little loose change in your pocket. For a while afterward, all your dimes and quarters will be radioactive enough to make a Geiger counter click. Subsequently, they'll contain a trace of cadmium metal that the U. S. Mint never put there.

What has happened? An atom of silver in the coin—say silver 107, which has 47 protons and 60 neutrons—picks up another neutron from the cyclotron. The result is silver 108, the isotope that contains one more neutron than silver 107. It is radioactive and emits a negative electron, or beta ray. As it does so, one of its neutrons turns into a proton. It therefore becomes cadmium, the element that has one more proton than silver; and the isotope is cadmium 108, which is stable.

Wizards of Oak Ridge similarly produce "radioisotopes" (radioactive isotopes) of elements ranging from antimony to zirconium. Given time, they could change the world around pretty radically, since all their radioisotopes eventually turn into stable elements—and these are usually quite dif-



Newly discovered curium, most dangerous to handle of all elements, is so violently radioactive that it bubbles and glows in this hollow glass needle. Photo was made by element's own light.

ferent from the elements they started with.

Naturally radioactive elements can also be duplicated. Polonium 210, the natural form that turns into lead, has been produced from bismuth in a high-voltage atom gun at the University of Michigan.

Awe-inspiring to earlier chemists was their powerlessness to start, stop, or control in any way the radioactive process that in nature's own good time gives birth to the various members of the radium, actinium, and thorium families. It could neither be hastened nor retarded by the most potent forces they could bring to bear—the searing heat of the blast flame, the frigid cold of liquid air, or the crackling discharge of millions of volts of electricity. But now the great 184-inch cyclotron of the University of California has shown how to give nature a boost. It turns uranium directly into a remote member of the actinium family, Actinium X—a process for which nature requires five successive steps and, on the average, more than 700,000,000 years!

In 1939, a cyclotron yielded a radioactive metal new to science—technitium, the first element to be discovered by its artificial creation. All newer elements, except fran-

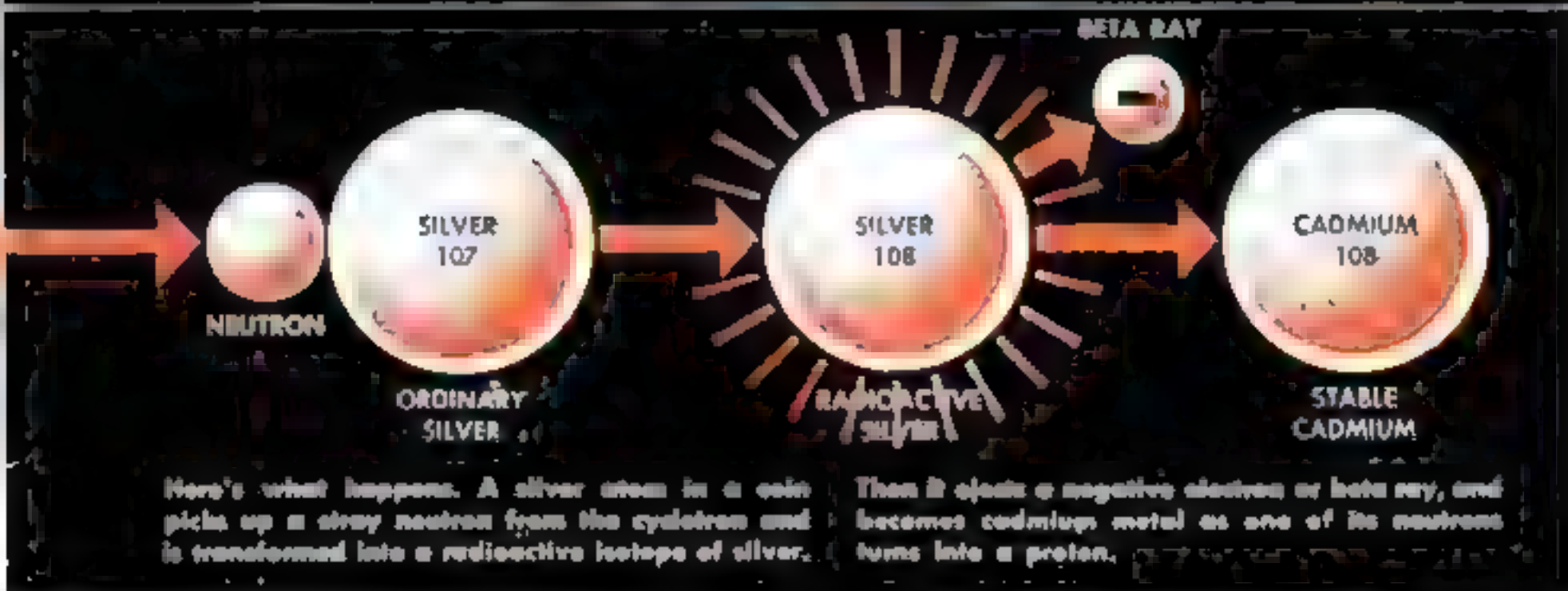
cium, have come from the cyclotron and atomic pile—astatine, neptunium, plutonium, curium, americium, and promethium. Plutonium, of atom-bomb fame, was also the first synthetic element made by the pound.

Promethium and technitium, the two synthetic elements believed most surely absent in nature, now are available from Oak Ridge. Substantial quantities could be produced as by-products of future atomic-power piles, if experimenters find they have important practical uses.

These men may well bear in mind the success story of the "Cinderella" element, columbium. As late as 1928, making a disk the size of a half dollar would nearly have exhausted the world's supply of this steel-gray metal. In 1929, a Chicago chemist proudly exhibited the first rods and plates of columbium—and frankly admitted he couldn't imagine any use for them. Today, as a result of wartime research, columbium has become indispensable. It forms a small but essential fraction of a heat-resisting alloy for the turbines of the world's fastest jet planes. Any one of the newest elements made by alchemists may likewise prove a necessity in the world of tomorrow. **END**

AMATEUR ALCHEMY

To duplicate the radiochemists' magic, you only need a dime and a chance to walk near a cyclotron in operation. A silver coin in your pocket will become radioactive enough to make a Geiger counter click. A trace of cadmium will be left in your coin.



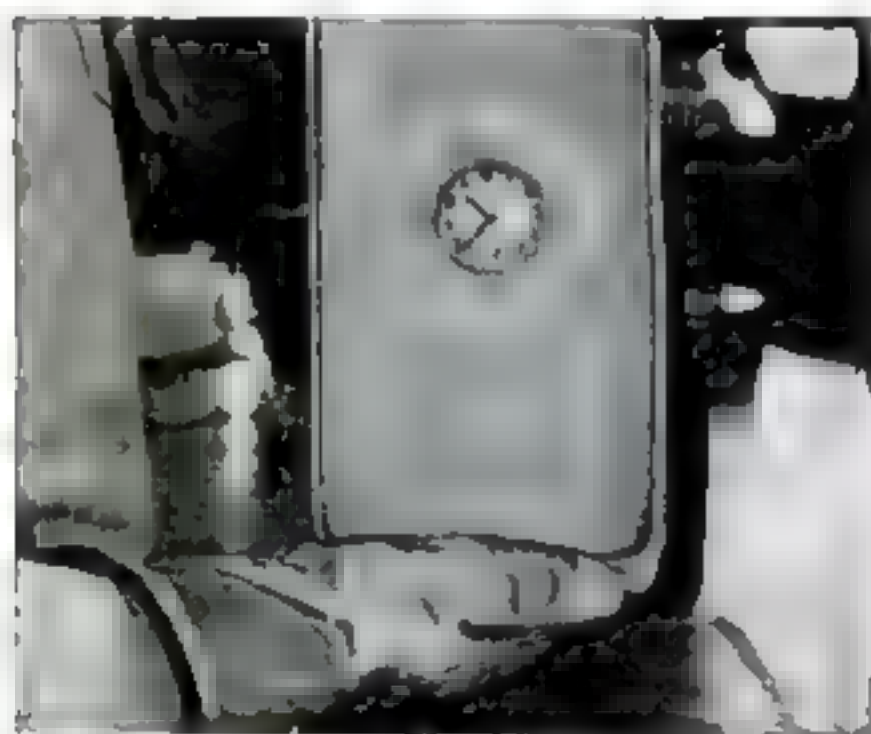


Invisible Light Talks

THIS modern Aladdin's lamp doesn't need magic to talk; its "voice" is built in. As the man in photo above, at left, talks into a microphone, the sound waves are changed into electrical waves and fed into the "talking lamp" and reflector outside the window. The lamp alternately dims and brightens thousands of times a second, sending out invisible infrared radiations. At a station three-quarters of a mile away, above at right, this "light talk" is beamed to a re-

flectorlike receiver. With the aid of a sensitive photocell, seen just above the seated operator's right hand, the message is reproduced into spoken words.

The tubular lamp that does the job is filled with argon gas and caesium vapor. Developed by Westinghouse for secret Navy wartime communication, this "beamcasting" cannot be jammed, and is unaffected by static. One suggested peacetime use is for disaster areas where other communications lines have been cut by weather conditions and ordinary broadcasting is impossible.



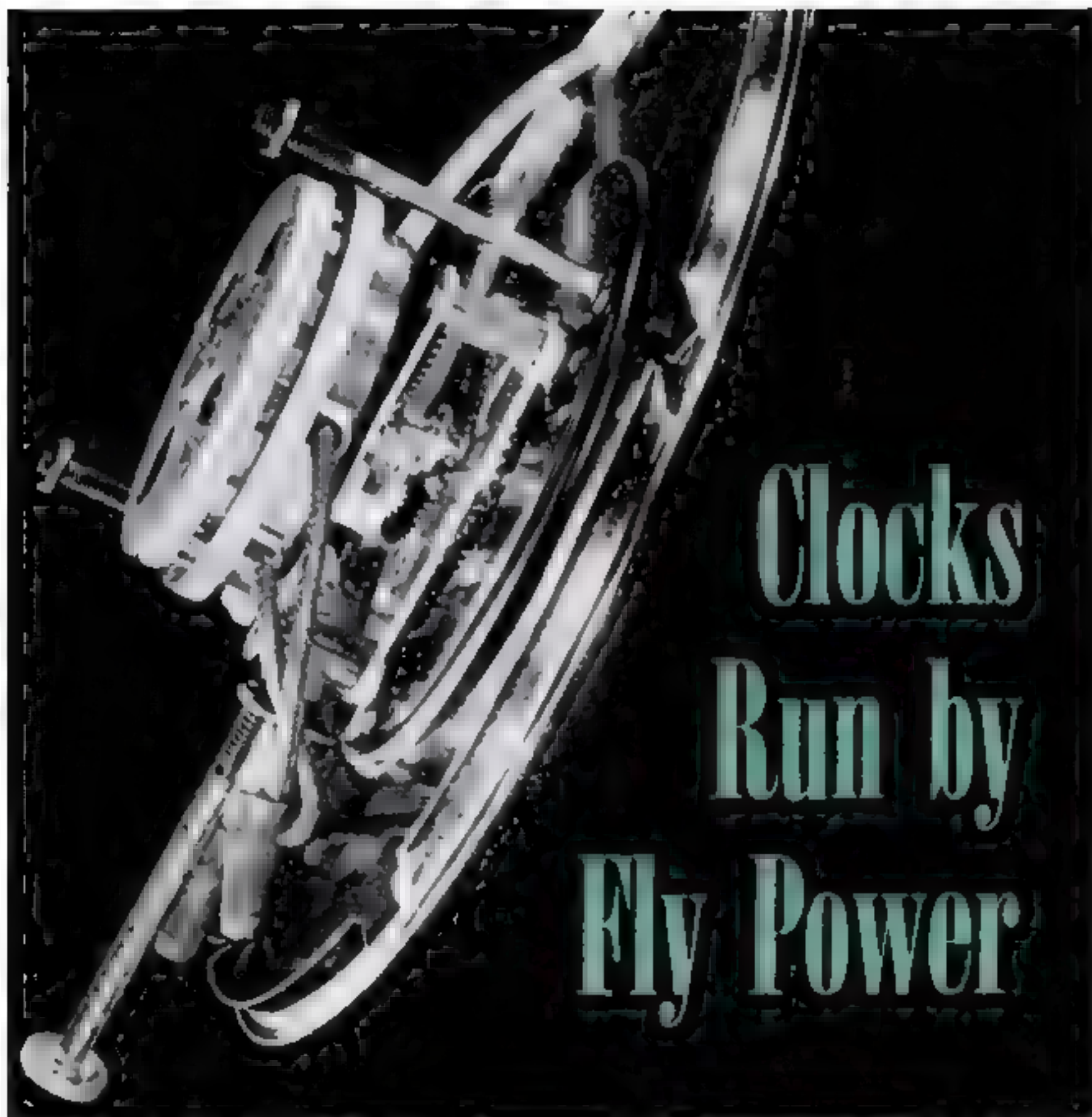
Cold Storage Time

THERE's not much point in keeping your watch in an ice tray as shown above, except to prove that new nonfreezing lubricants developed by Cities Service Co., enable it to tick away in sub-zero weather. But polar explorer and winter motorist alike will benefit from these special lubricants, some of which remain fluid at 70° below zero.



Watching a Close Shave

How smooth is an electric-razor shave? That's what Schick Electric Shaver engineers are finding out with this gadget. As the razor's shearing head clips whiskers at 8,500 r.p.m., motion appears to stop when the disk held in the technician's hand is revolved at the same speed. This permits close examination of shaving performance.



Clocks Run by Fly Power

Driving this electric clock is the small, can-shaped motor between bolts. Rest is gearing.

Electric clock motors may cost only 25¢, give 10 millionths of one horsepower—yet they keep perfect time.

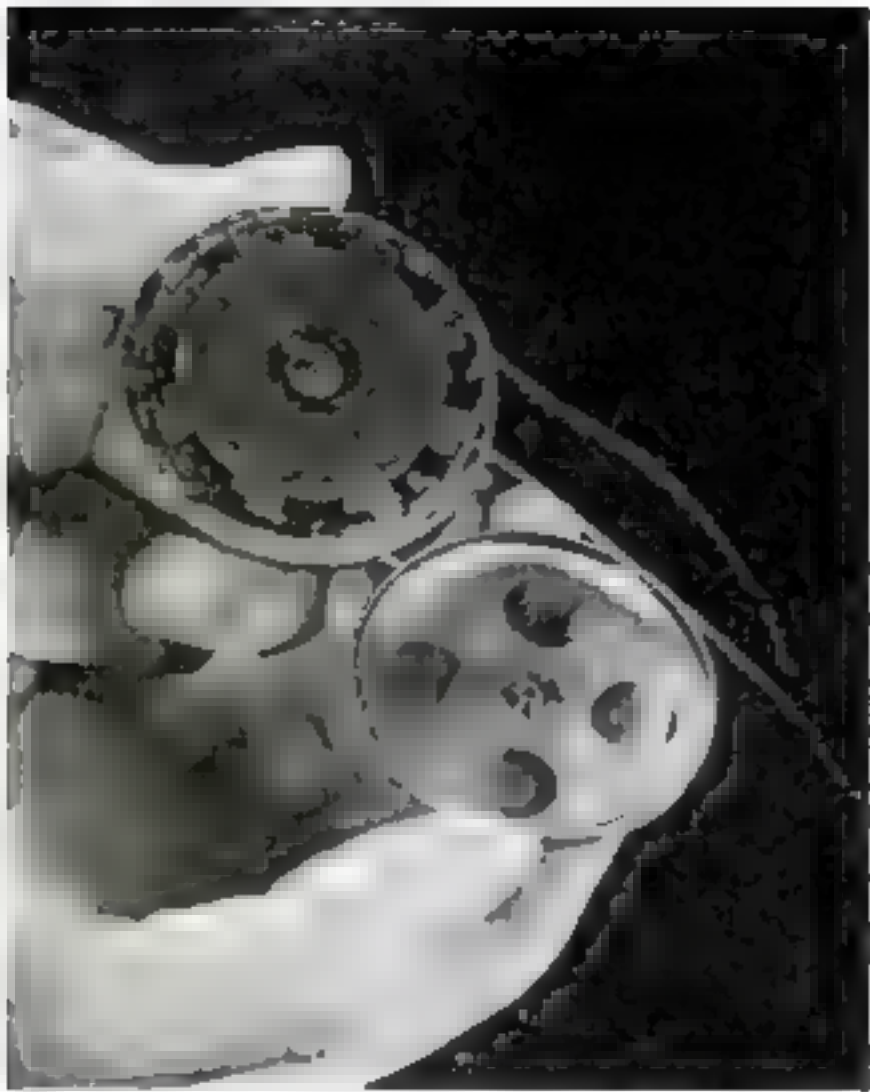
By Benj. F. Bailey

*Professor Emeritus of Electrical Engineering,
University of Michigan*

A 50 000-HP electric motor may drive a big ship, a 5-hp. motor may turn a lathe, and the dentist can do his dirty work with a drill driven by a motor of perhaps 1/100 hp. But what can a *fly-power* motor do? For one thing, it can drive an electric clock or any other small device that must run at constant speed, such as a meter, recording instrument, or time switch.

I don't know how much power one fly-power is, but I have no doubt a healthy fly could operate an electric clock. Tests made about 25 years ago show that the actual power required to run an ordinary house clock is about two-billionths hp. Some of the clock motors I have tested showed outputs 5,000 times greater—about 10 millionths hp.—certainly an ample margin. And although these motors have a low efficiency (much less than 1%), the cost of power is only about one cent a week.

Such a motor is neither complicated nor expensive. The simplest form can be manufactured and sold at a profit (in large quantities) for as little as 25 cents. Motors of this kind have been on the market for about



This motor, from a self-starting electric clock, has a rotor made from a narrow spring-steel band snapped into an aluminum flywheel shown above, at right. Stator, of notched iron, is at left.

20 years but were invented long before that. One was patented in 1894 by a German, Carl Coerper, while a similar motor by La Cour dates back to 1868. This particular one did not use alternating current; in fact, the inventor probably did not know it would run on AC. He used an interrupted direct current timed by a tuning fork.

It is hard to imagine a simpler motor than this type. The rotor is a notched disk of soft iron, either solid or laminated, about $\frac{3}{4}$ to 1 $\frac{1}{2}$ inches in diameter and perhaps a little more than $\frac{1}{16}$ inch in thickness. The stator (really technically the armature) is usually laminated, but it operates well even if solid. The exciting coil consists of a few ounces of very fine wire. This completes the motor, except for the shaft and bearings.

Runs at Constant Speed

This is a single-phase, synchronous motor and it runs at absolutely (I don't mean nearly) constant speed as long as the frequency of the current is constant and the load is not too great. If overloaded, it stops completely and must be started by outside power before it will run again. Its speed is such that any given tooth moves ahead to the position occupied by the next tooth in one-half a cycle. Thus, on a 60-cycle cur-

rent, a rotor with six teeth makes a complete revolution in three cycles, 20 revolutions a second, or 1,200 r.p.m. Being perfectly symmetrical with respect to the poles, it runs equally well in either direction.

What makes such a simple device run? When it was first proposed, many electrical engineers declared it would not run at all. It looks as though each tooth would be first pulled ahead and then pulled back. This actually occurs, but fortunately it is pulled ahead harder than it is pulled back. If a rotor tooth were directly in line with a stator tooth at the instant of greatest magnetic force, there would be no resultant pull. Actually, the stator tooth arrives there a little later, and is consequently pulled ahead while the force is strong, and backward while it is weak. Thus the forward pull is greater than the backward pull, and the motor keeps running, the rotor's inertia carries it over the positions of back pull.

Off to a Bad Start

When first used to drive clocks, in 1896, this type of motor was a flop. It was difficult to start, and it did not keep good time after it was started. Otherwise it was all right. In other words, further improvements were needed. To start it you hand-twirled the rotor somewhat above synchronism. At some instant as it slowed down, it was at exactly synchronous speed. If at that instant the poles were exactly where they should be to develop maximum pull, the motor would "take hold" and run indefinitely. In practice, however, it usually was not near enough to the best position, and the motor stopped.

Actually, a method of overcoming this starting difficulty had been invented by the aforementioned La Cour. He used a hollow flywheel partially filled with mercury. A later and better idea was to mount a very light flywheel loosely on the shaft but connected to it by a light friction clutch that slipped easily. In still another, the flywheel was connected to the shaft by a fine spiral spring. With any of these devices, the rotor could change its speed momentarily without accelerating the flywheel.

In another very simple starting device, the slots on the rotor (or stator) are angled to allow plenty of end play in the shaft bearings. Then, if the rotor is not in the best running position when it reaches synchronous speed, magnetic force of the teeth will pull it endwise into such a position.

Such a motor is not self-starting. A self-

starting motor has the advantage of convenience. But if the current is interrupted for a few minutes, it will start as soon as the power is restored and will be several minutes slow. In some self-starting clocks little red warning disks appear on the face if the current stops. A few have an auxiliary spring-driven movement that takes over until the power comes on again.

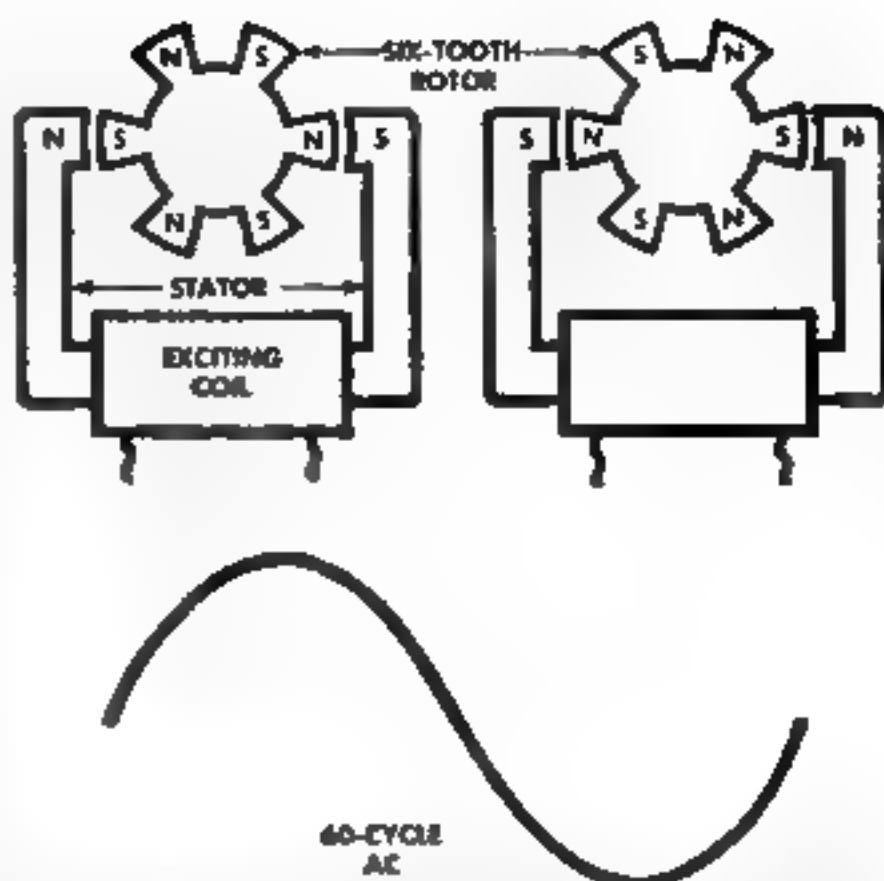
There are many forms of self-starting motors. One common type uses bands of copper, called shading coils, to make the magnetic field of the stator rotate. This rotating field causes the north and south poles in the disk-shaped rotor to move around with the field, creating a pull that brings the motor up to synchronous speed. Once the rotor is in synchronism, its poles usually hold their position. Sometimes they may shift, however, slowing the rotor below synchronism. This loss of speed can be prevented by mounting a rectangular bar of hard steel on the rotor shaft, close to the rotor. Since poles of a bar cannot move around like the poles of a disk, the bar always stays in synchronism, and holds the disk in synchronism.

With these improvements, a good motor was available, but its accuracy was no greater than that of the frequency of the electrical system to which it was connected. If the current alternated at 60.6 cycles instead of precisely 60, every clock would gain about 15 minutes a day.

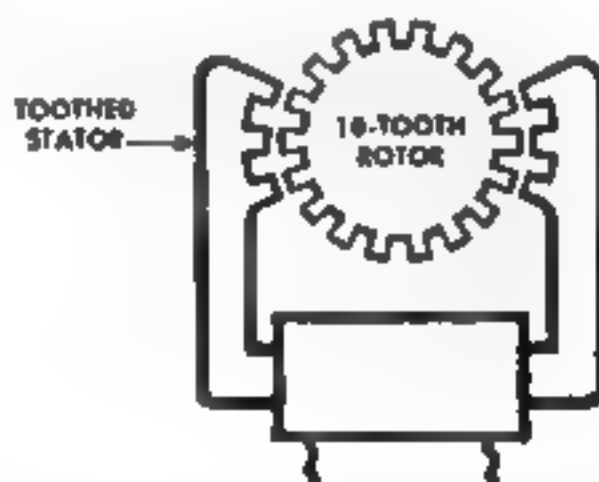
Frequencies Must Be Controlled

Before electric clocks could be generally used and sold, the current frequency had to be held between about 59.994 and 60.006 cycles (in a 60-cycle-AC system). This is done in the powerhouse by having a high-grade pendulum clock and an electric clock. The attendant keeps the two regulated by varying slightly the speed of the steam engine. In up-to-date powerhouses, this adjustment is automatic. Once a day, perhaps, the pendulum clock is corrected by checking time signals from Washington.

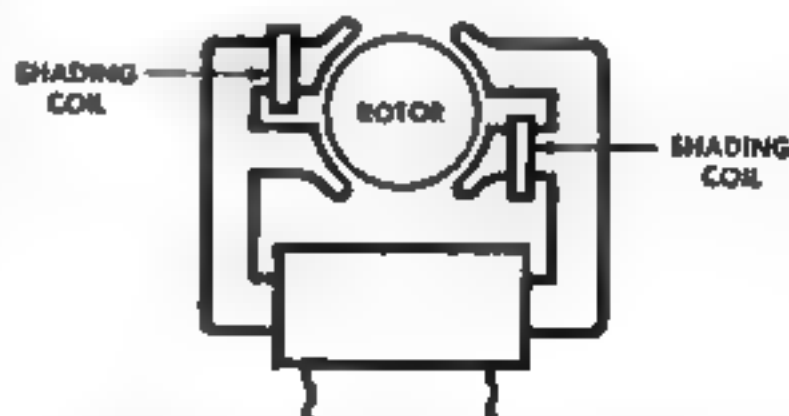
Before closely controlled frequencies became available, however, someone had to convince the power companies that the expense was justified. Once one or two large companies started to provide closely regulated frequency, others quickly fell into line. Now most companies provide excellent time service. Today, even the cheapest electric clock keeps better time than an expensive pendulum clock. END



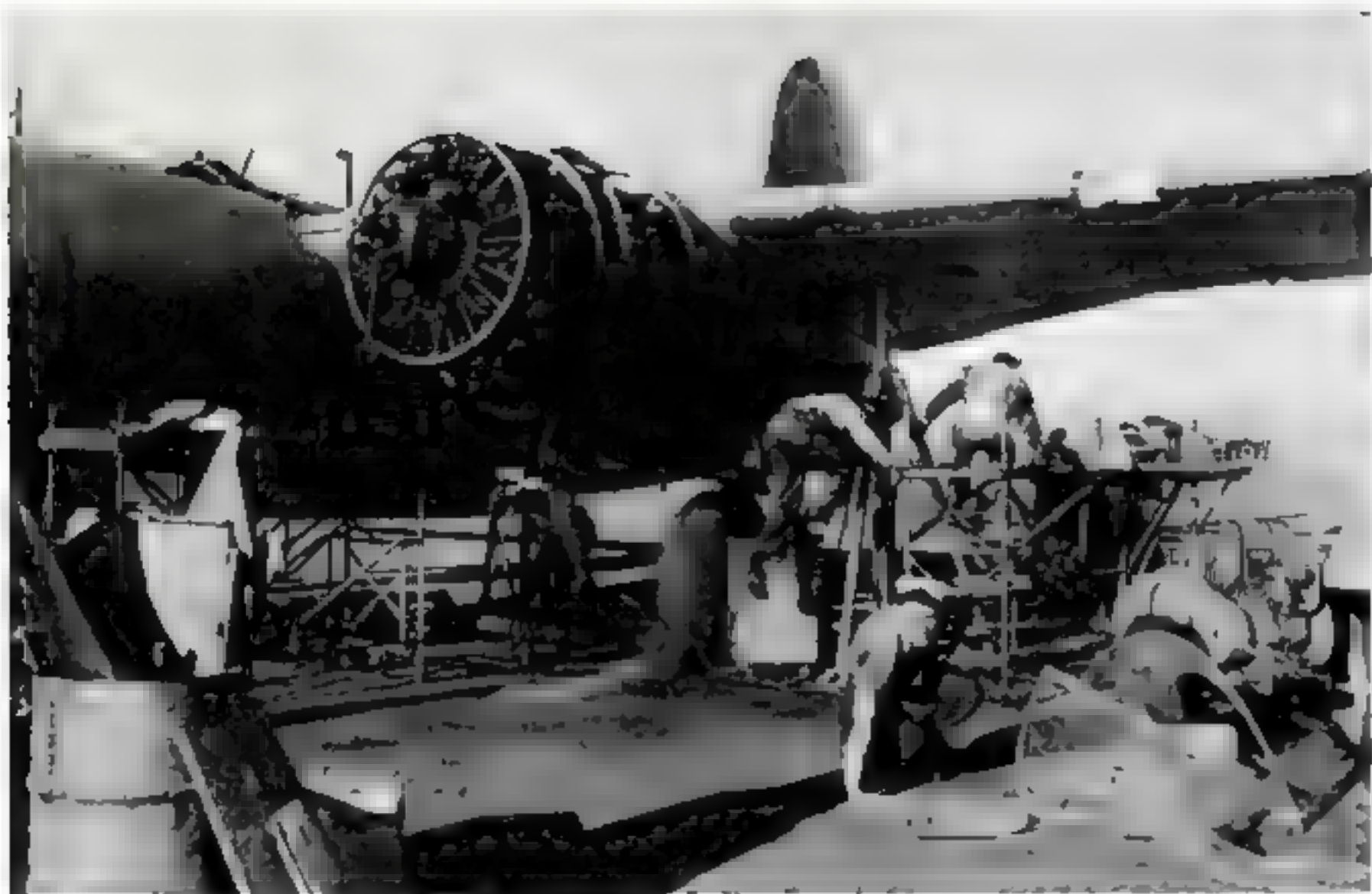
When alternating current is at its maximum, the poles are about as shown here, and the pull is strong. Beyond this point the pull is backward, but the current is weaker. Thus the forward pull is greater than the backward pull, and therefore the motor continues to run.



Notches are cut in the rotor to increase the number of poles and reduce its speed. The rotor moves two notches for each current cycle, so the above 18-notch rotor turns 400 r.p.m. Notches in the stator increase the pulling power of the motor but do not change the speed.



One kind of self-starting synchronous motor has a shading coil around half of each stator pole to make the magnetic force in the shaded half lag behind that in the unshaded half. A rotating field results, pulling the rotor poles with it and exerting a force that starts the rotor.



The wrecking crew begins dismantling an A-26 bomber, which will soon be reduced to a pile of anonymous ingots and a few useful parts. After

engines, instruments, and landing gear have been removed, the remains are blowtorched into pieces small enough to fit in a furnace



The last remnant of a once-mighty bomber disappears into the flaming jaws of an oil-fed melting furnace, where temperatures up to 1,500° F. will quickly convert it to a molten alloy



End of the line. Freshly cast ingots, stacked in neat piles, await their reincarnation as instruments of peace. In the background, the molten alloy is being poured into the molds.

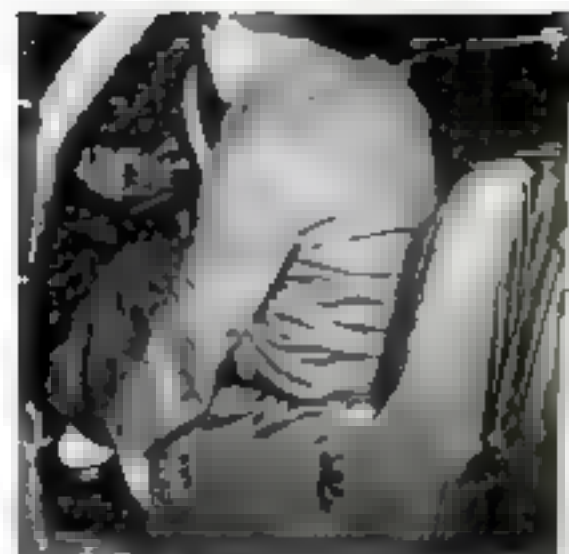
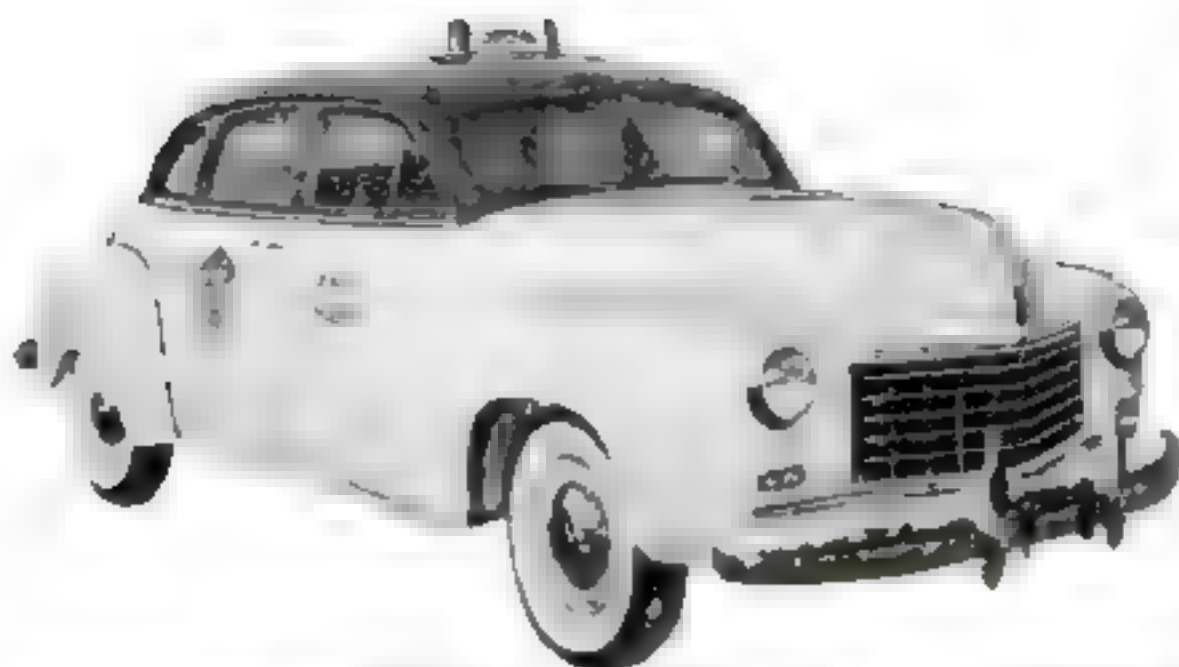
New Pans from Old Planes

IN MANY an American home, the morning's breakfast eggs are frying on the wing of a bomber that once dropped different "eggs" over Germany and Japan.

At the North Island Naval Air Station, San Diego, Calif., obsolete and battered warplanes are being melted down. Most of them will end up as such peacetime utensils as pots, pans, and skillets. More than 2,000

planes, from fleet-winged fighters to lumbering Coronado flying boats, have already passed through the furnace, and others are joining them at the rate of 800 a year.

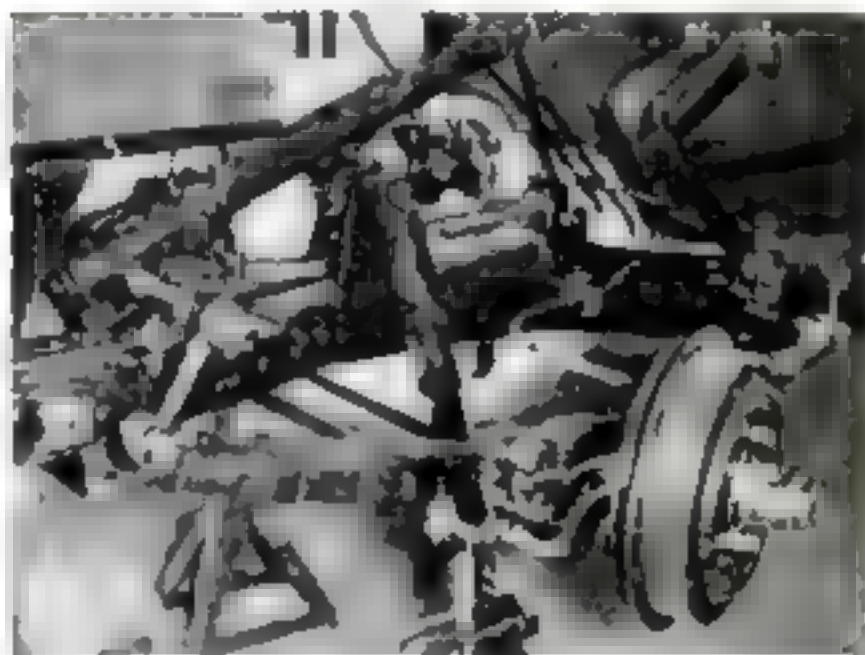
Stripped of all usable parts, the carcasses are cut apart, melted, and cast into ingots. These 15-pound bars of aluminum alloy are then sold to the highest bidders for an average price of about 8½ cents a pound.



For driving comfort, the seat adjusts to different positions.



Placing the engine forward gives limousine seating capacity on a wheelbase of only 124".



Semi-elliptic springs and a rigid axle were restored at the insistence of owner-drivers.

New Shorter Taxicab Scraps Knee Action

BECAUSE taxi drivers have long complained that knee action is costly to keep in service, the Checker Cab Manufacturing Corporation has gone back to a rigid front axle and two semi-elliptic springs in a short-wheelbase model it's producing this year.

By locating the six-cylinder Continental engine over the axle, the manufacturer conserved enough space to shorten the wheel-

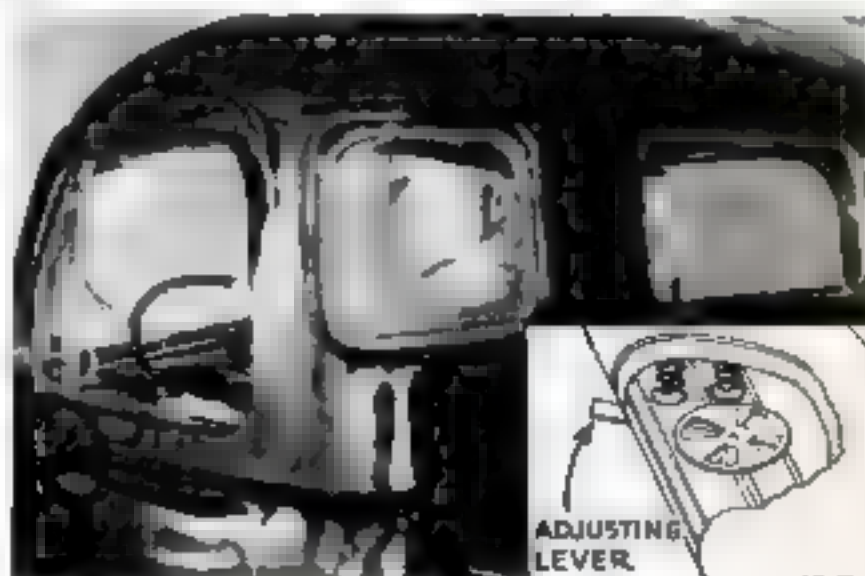
base to 124", about 17" less than many taxicabs, and yet retain a body large enough to accommodate five passengers, three on the rear seat and two on auxiliaries. The overall length is 206".

Safety features include a buzzer that sounds when the vehicle is backing, crash pads, finger shields on the doors, and a light that glows if any door is open.

Corner Windows Allow Truckers to Look Back

REAR quarter windows in the deluxe and custom cabs of 1948 Dodge trucks allow drivers to back into alleys or up to loading docks with greater ease. They don't have to crane their necks out the door to look behind them.

Another point of interest is the "Air-O-Ride" seat. In this, cushioning is provided by air as well as coil springs, the seat cover being airtight except for an adjustable valve (extreme right). The valve openings may be varied in size for a soft or hard ride.



Detective X-Ray Billings could pry secrets from everything but his car.

Gus and the Private-Eye Caper

By Martin Bunn

THE late afternoon highway traffic was heavy. Gus Wilson came to a stop behind the middle-aged convertible that headed the outside lane of cars waiting for the light to turn green.

Sitting idle for a moment, he noticed that the driver of the convertible, a fat man with a red face and a redder neck, was staring fixedly at the car alongside his in the inside lane—a cream-colored roadster that featured white-sidewall tires and plenty of gleaming chromium. He also noticed that the swarthy, hatless occupant of the roadster was watching the fat man out of the corners of his eyes. Thin lips beneath his eyebrow-narrow black mustache were twisted in a curious smile.

As the signal winked from red to green, the roadster shot ahead. The convertible stood still. Half way across the intersection the roadster's driver looked back. From



between scornfully protruded lips he ejected a loud and contemptuous "Phooey!"

Impatient horns honked, but the convertible didn't move. Its driver pushed his dusty derby farther back on his head and stamped on the starter button. After half a minute of resultless effort he turned around and yelled to Gus: "Hey, mister—I'm stalled. Gimme a push, willya? Make it a fast one—she won't take aholt 'til she's up over twenty."

Gus nodded and eased his front bumper against the convertible's rear one. With an eye on the speedometer, he began to push. When the indicator climbed to 22 he felt

the convertible pull away. It swerved into the inside lane and when Gus came abreast the fat man shouted: "Thanks, mister. My darned ole motor stalls 'most every time I have to stop at a light, and I gotta ketch that roadster that was alongside me."

STANDING in his shop doorway, Gus was enjoying a between-jobs pipe and breath of air when a convertible with its top down swerved off the street, shot up the Model Garage driveway, and braked to a spine-snapping stop. The engine continued to roar.

The derby-hatted fat man whom Gus had

Nick produced a roll of bills and peeled off a ten-spot. "O K. So it wasn't the carburetor," he said



assisted a week earlier climbed out. "You Gus Wilson?"

"That's me," Gus conceded.

The fat man fished a card from a pocket of his rumpled coat. Gus read:

XAVIER RAYMOND BILLINGS

. Investigations

Confidential--Comprehensive--Conclusive

"That's *me*," said the stout detective. "Call me X-Ray. Everyone in the investigative game does—from my name and because I always see through things. Say, you look sorta familiar. Wait a minute—I never forget a name or anything else . . . You're the feller gave me a push at that traffic light the other day."

Gus grinned. "Catch up with that fancy roadster?"

X-Ray shook his head glumly. "The feller who was drivin' it is a private eye, too. Right now we happen to be workin' on the same caper—that's what we call a case in the profession—only for the opposin' parties. He's one of them know-it-alls, and ever since I been having trouble with my car he's been kiddin' the pants offa me."

"What's the matter with your car?"

"You saw what's the matter with it, up there at the crossroads," X-Ray grumbled. "I can't hardly ever get the motor started without someone giving me a push, and then it stalls every time I let it idle. It'd be stalled now, only I left the throttle out . . . Take a look at it."

"Drive it into the shop."

X-Ray buck-jumped the convertible through the doorway and got out, leaving the engine racing.

"How long have you been having trouble?" Gus asked.

"Well," X-Ray admitted, pushing his derby even farther back, and scratching his head, "she's been sorta hard to start, and apt to stall on me, for quite a spell. But it's only the last couple of weeks that she's been actin' up real bad."

"Have you done anything about it?"

"Sure I have! When she began stallin' all over the place, I figured it was the spark plugs, so I checked 'em. It looked like they'd burned until there was twice as much gap as there ought to be, so I cleaned and adjusted 'em."

"What happened?" Gus queried.

X-Ray shook his head sorrowfully. "I did that job the night before you helped me

get started at the traffic light," he said. "You saw what happened . . . Well, there's a feller boards with the wife and me—I ain't mentionin' any names, you understand—who thinks he knows a lot about cars. Ever since I been having trouble he's been saying there's something wrong with my carburetor, and I've been telling him he's nuts. The day after you helped me out he borrows the service manual for my model, and brings it home with him. It says that my carburetor has a low-speed jet and a low-speed air-admission system with some very small passages in it, and that any little particle of dirt in those passages will mess up the way the motor idles."

"Well, that makes me wonder if maybe he could be right, so we take the carburetor apart and clean it. When we put it back, the motor is worse than ever."

"I tell this feller that he's nuts, but he still claims that the carburetor must be clogged—only we didn't know enough to find it. Finally he talks me into taking it to a carburetor specialist. After two days it comes back lookin' all clean and pretty. But when we get it on the car, what happens? The motor won't start! And when I get it started on a fast push, it dies as soon as I try to make it idle. My friend still says it's carburetor trouble, and I claim it's something else—only I don't know what. By that time we're both sore, and we put a ten-buck bet on it. Then a neighbor who's been kibitzing on the job says I'd better bring the car over to you . . . Find out what's the matter with her."

"O.K.," Gus agreed placidly. He got into the convertible and pushed the throttle knob in slowly. As he cut the engine down, it coughed and quit.

Gus got out, raised the hood, and snapped off the distributor head. He removed the rotor, and after a brief inspection looked up at X-Ray. "You win," he told him. "It isn't the carburetor."

X-Ray slapped a massive thigh. "Ten bucks! That'll learn him!" His face clouded. "Hey, mister—can you prove it?"

"Sure. Just take a look at this—"

"Hold everything!" X-Ray yelled. "Where's your 'phone? He'll never pay me that ten bucks unless he *sees* you prove it!"

Following the direction of Gus's nod, the fat man lumbered into the office. "He'll be here in a few minutes," he reported when he got back.

Gus grunted, went over to the convert-

ible, and started doing something to its distributor. Just as he finished a man wearing a polo coat and no hat came into the shop. Gus was surprised to recognize the driver of the flashy roadster who had been so contemptuous of the stalled X-Ray.

"Nick Butler—he's in the investigative game, too," X-Ray introduced. "Go ahead—prove it wasn't the carburetor."

"All right," Gus agreed. He cranked the engine over slowly until the breaker arm rested on the lobe of the cam. With a feeler gauge and point wrench he set the points at the correct .018" gap. Then he replaced the rotor and distributor cap, got into the car, and merely touched the starter button. The engine took off instantly. When he throttled it down it idled smoothly.

Nick produced a roll of bills and peeled off a ten-spot. "O.K.," he said. "So it wasn't the carburetor. But it couldn't have been the distributor, either—there was a good spark once the engine got running."

Gus again took the cap off the distributor, and removed the rotor. "Take a look at that," he said. "Only the lobes of the cam are shiny—its flats are dull and dark. That showed me that the fiber block on the breaker arm—I just replaced it—had worn so much that the points barely opened when the cam turned. If X-Ray had put a touch of petroleum jelly on the cam, and checked his point gap once in a while, he would have saved himself a lot of grief—and if the two of you had checked the ignition system instead of having the carburetor overhauled

because the trouble *seemed* to be in it, X-Ray would have saved himself money. The condition got worse until, at low speeds, the cam didn't lift the arm enough to break the points apart cleanly and get a spark. Then the engine wouldn't start or idle. At high speeds, though, the cam flicked the arm fast enough to give it momentum that threw it clear."

Nick nodded. "You did a nice job of detecting for a pair of dumb dicks," he said. Then he turned to X-Ray. "Subject X is going to meet Subject Z tonight," he said. "You tail him, will you?"

"I can't," X-Ray growled. "I gotta take the wife to the movies. You do it."

"I got tickets for the fights, down in the city," Nick objected. "You can go to the movies any night."

"Match you for it," X-Ray said.

Nick lost, and went out scowling.

"I thought you fellows were working for opposing parties," Gus said.

X-Ray grinned. "We are," he admitted. "But if both parties get the info they're paying for, what difference does it make who gets it? I figure that cooperation gets a man further than competition—live and let live, that's my motto!"

END

Trouble Pays—Sometimes

Had any interesting breakdowns lately? Gus wants to hear about your tough and tantalizing car ailments. Write him (on a government postcard) about the false diagnoses as well as the cures. P's will pay \$5 to \$15 for usable ideas, but cards cannot be acknowledged or returned. Address: Martin Bonn, POPULAR SCIENCE, 333 Fourth Ave., New York 10, N. Y.

"I thought you were working for opposing parties,"
X-Ray grinned "We are."



Hints from the



1. Avoid Freeze-ups.

A roll of masking tape has been a valuable item this winter in the Model Garage. Before a car is washed, pieces of tape are placed over the door and trunk locks. Even though some of the cars were taken out at once into below-zero weather, there hasn't been one complaint of frozen locks.

2. Tool Reaches Drain Cock.

An old brake rod may be turned into a handy tool for reaching drain cocks that are difficult to get at. Simply hacksaw off one end and bend to form a handle.

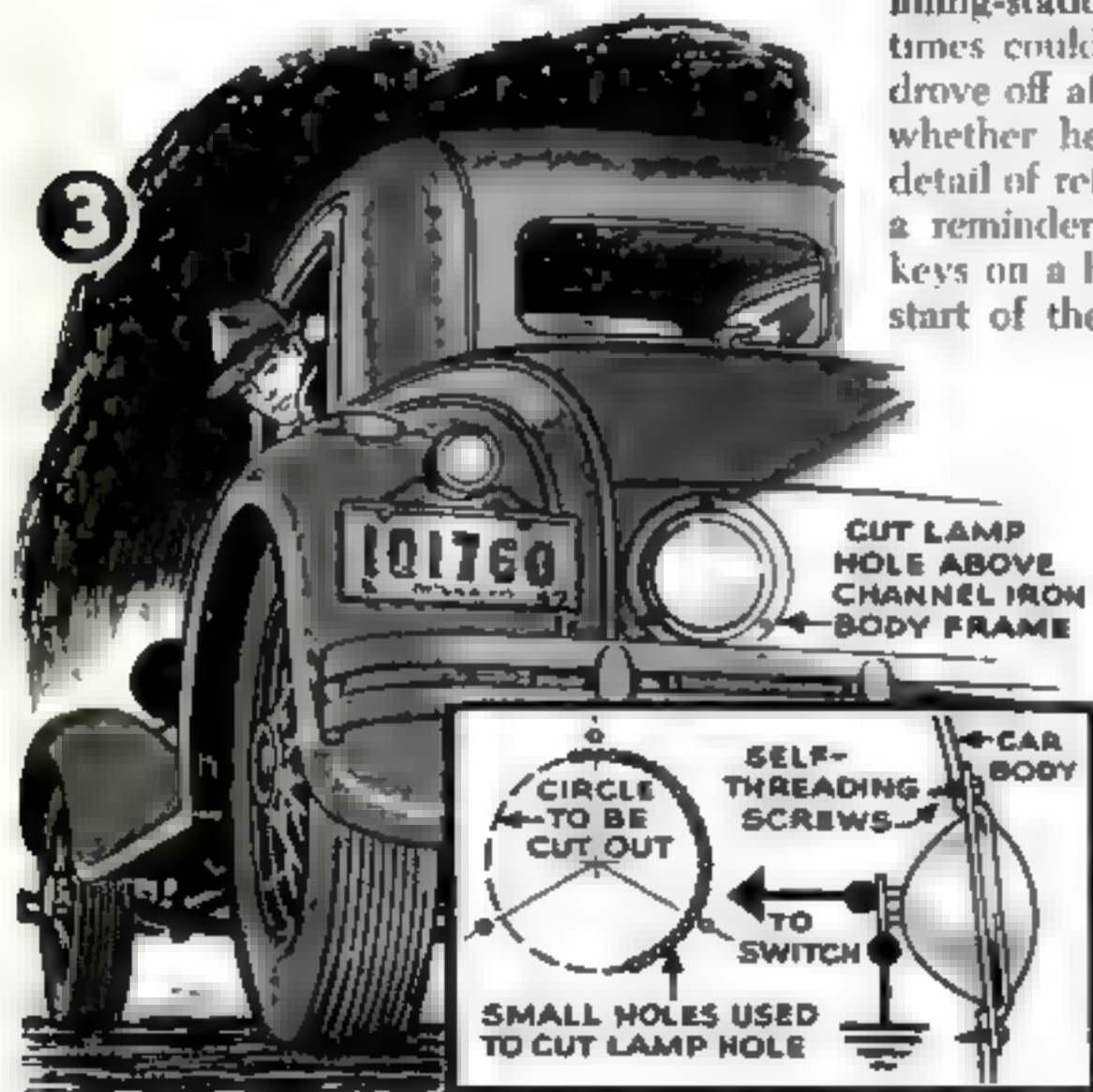
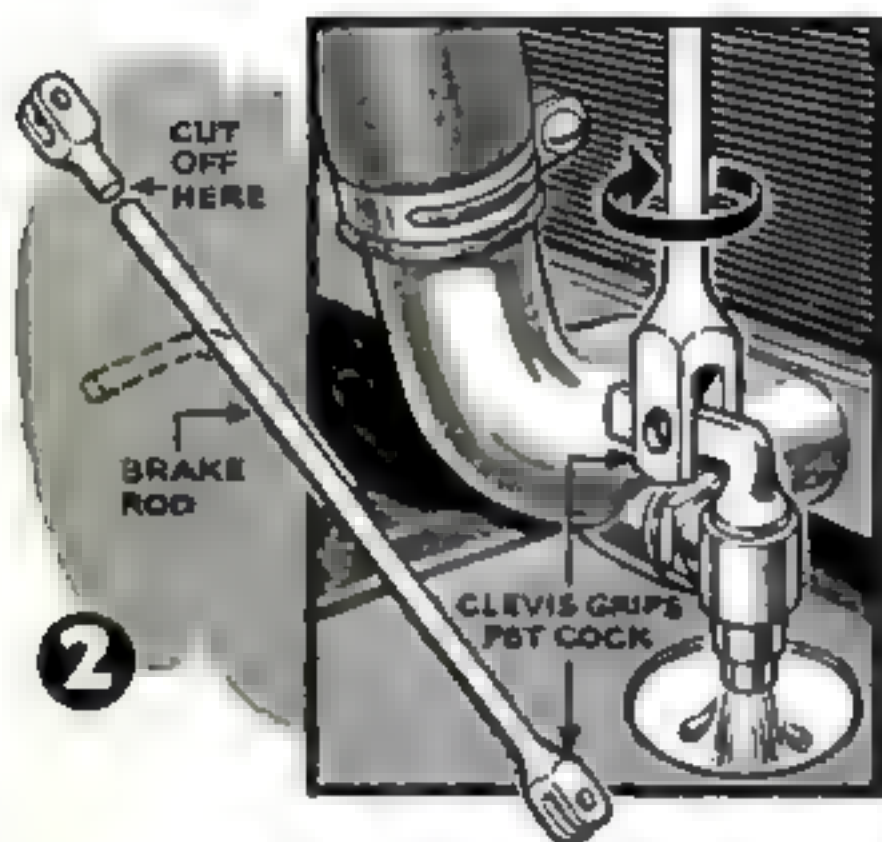
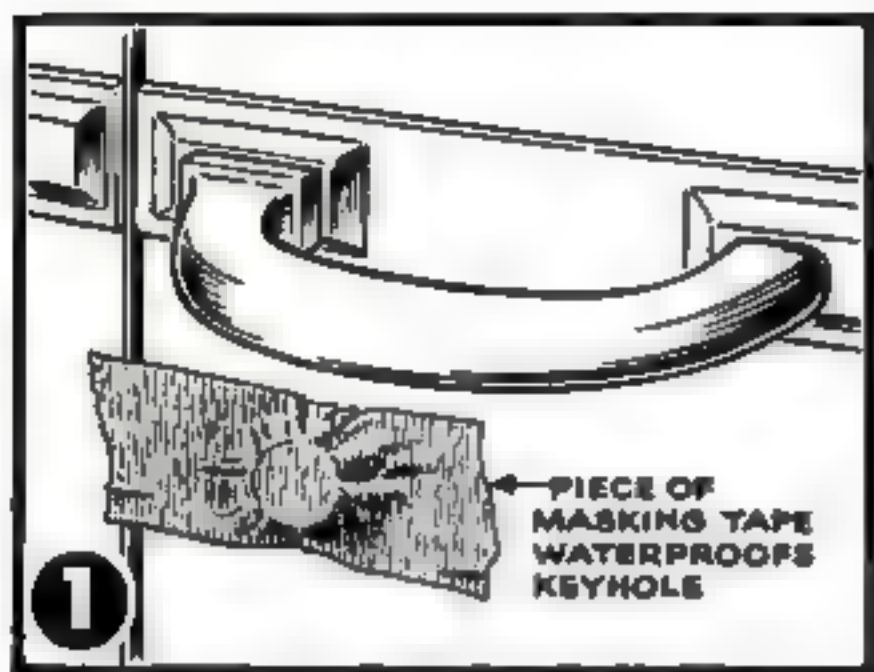
3. It's a Back-up Light Now.

Francis Hewens, of Boonton, N. J., reports he's using a sealed-beam headlight with one filament gone as a back-up light on a car he has. A hole slightly smaller than the rim was cut by drilling overlapping holes. One wire was run from the live filament to a switch on the dash, the other to ground.

4. You Can't Forget the Oil.

One filling-station attendant found that he sometimes couldn't remember, when a customer drove off after an oil change and grease job, whether he had overlooked the important detail of refilling the drained crankcase. As a reminder, he now always hangs the car keys on a hook on the filled measure at the start of the job. Simple, but effective.

Drawings by Stewart Rouse



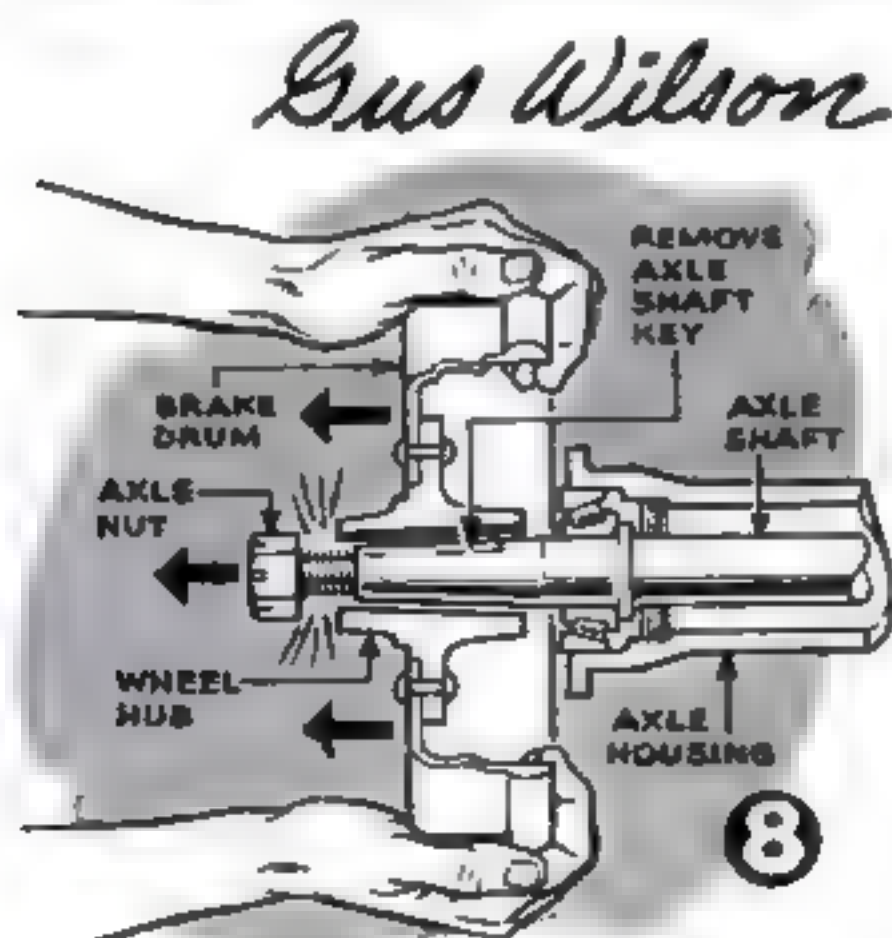
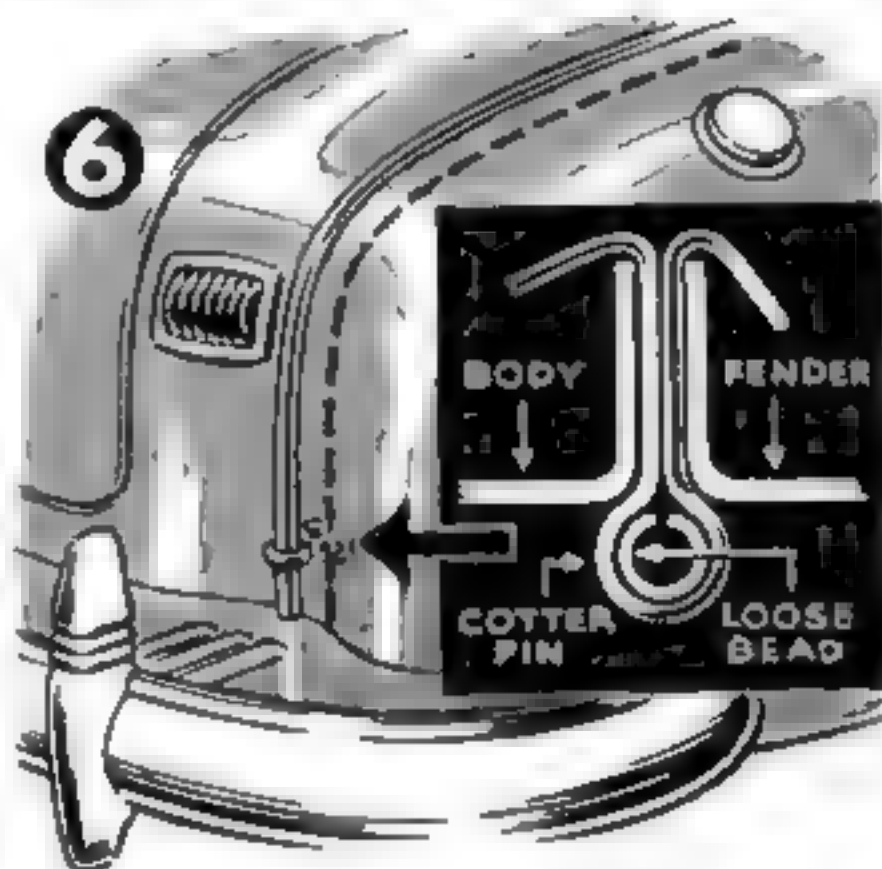
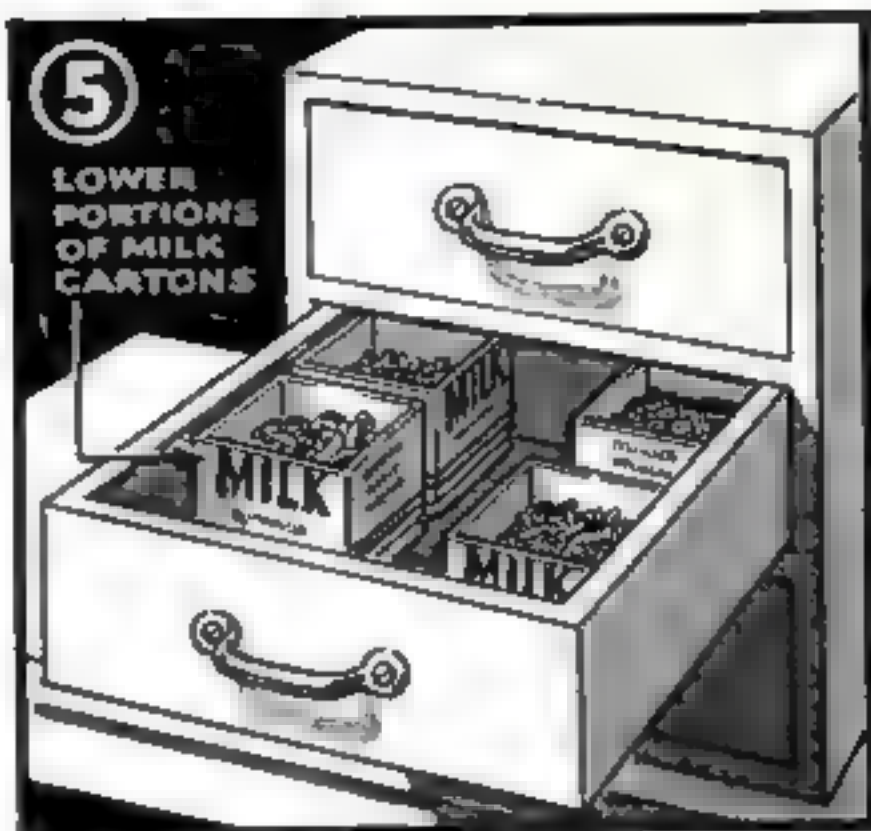
Model Garage

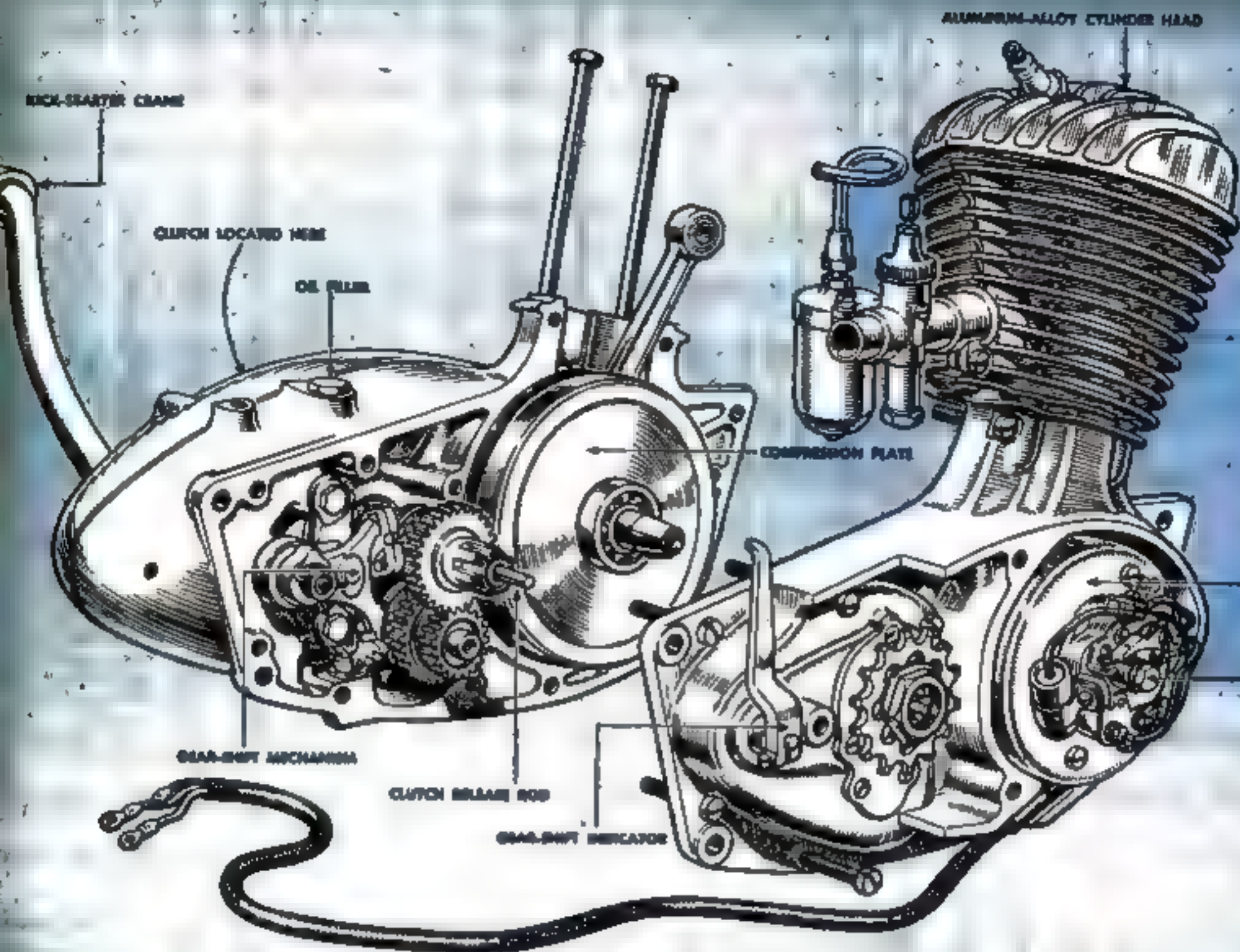
5. Parts Kept in Order. When J. C. Branstetter, of San Francisco, begins any extensive car repair, he always carries to the job several boxes made by cutting the tops from milk cartons. As he removes bolts and fittings, he keeps each group separate and drops a piece of paper in the container listing where the parts came from.

6. Cotter Pin Holds Bead. In some cars, a chrome bead finishes off the joint where the fenders meet the body. In time the fabric that ties it to the joint may rot, allowing the bead to spring out. One or more large cotter pins, slid over the bead, pressed into the joint, and then opened out, will keep it in place.

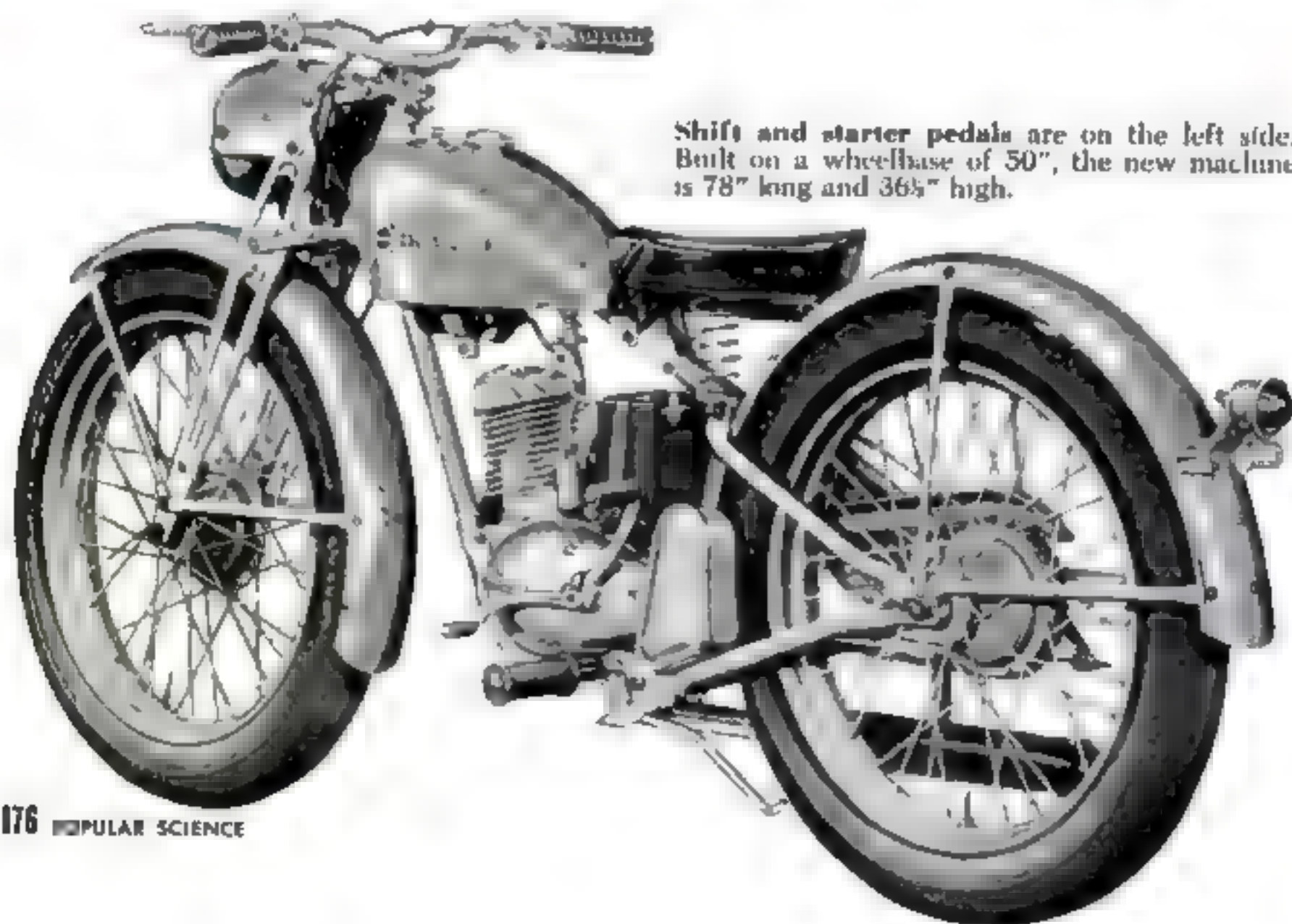
7. Clean the Trunk Gutter. It's a good idea to clean the gutter around your trunk compartment regularly. If dirt is allowed to accumulate, rain water may seep in even though the lid fits well.

8. Brake Drum Pulls Axle. Carl Vogel, of Chicago, points out that the brake drum may be used to pull the rear axle on Chrysler-made cars. After removing the wheel, drum, and shaft key, replace the drum and turn up the axle nut four or five turns. Then rap the drum against the nut several times and the axle will come out.





A plate set into the flywheel reduces crankcase volume and increases the compression ratio.

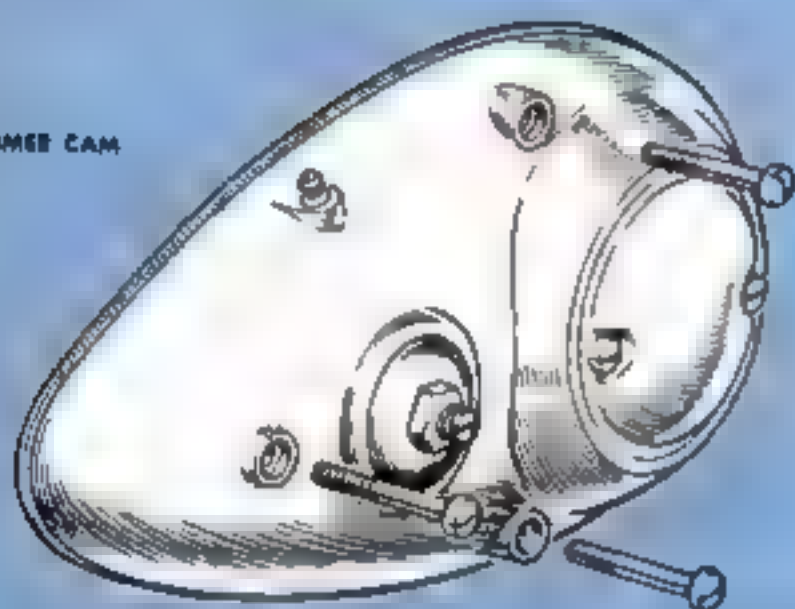


Shift and starter pedals are on the left side. Built on a wheelbase of 50", the new machine is 78" long and 36 1/2" high.

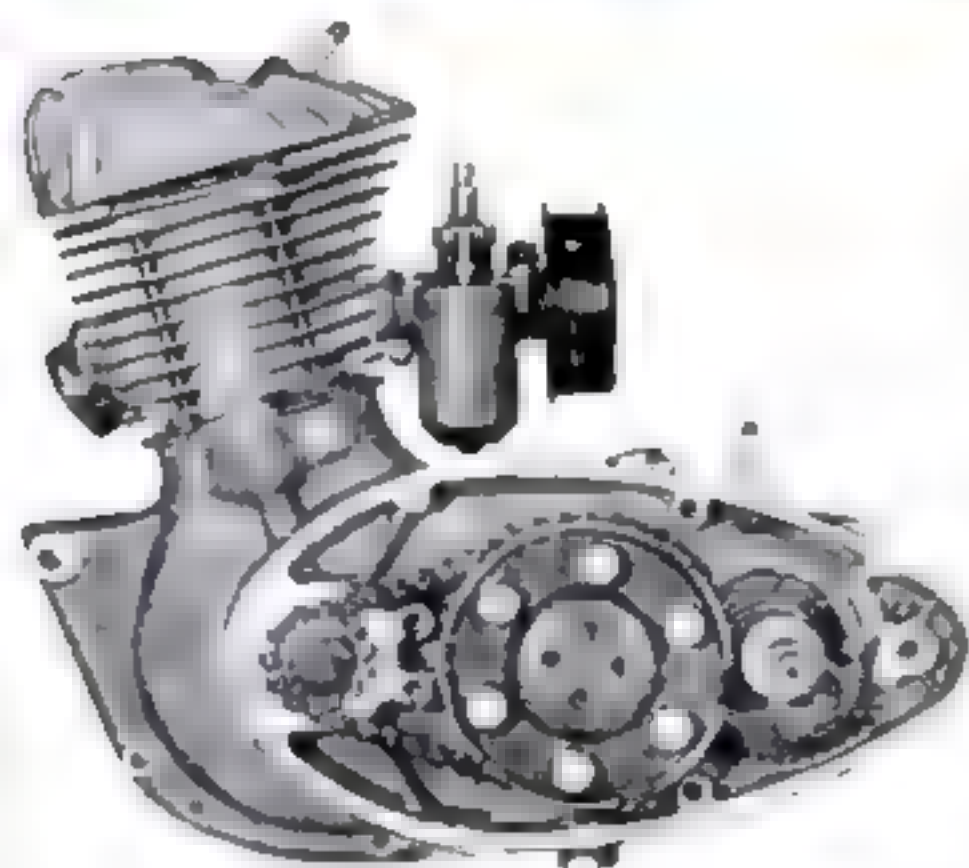
Two-Cycle Harley Shifts by Foot

GENERATOR

TIMER CAM



An indicator shows the gear that's engaged.



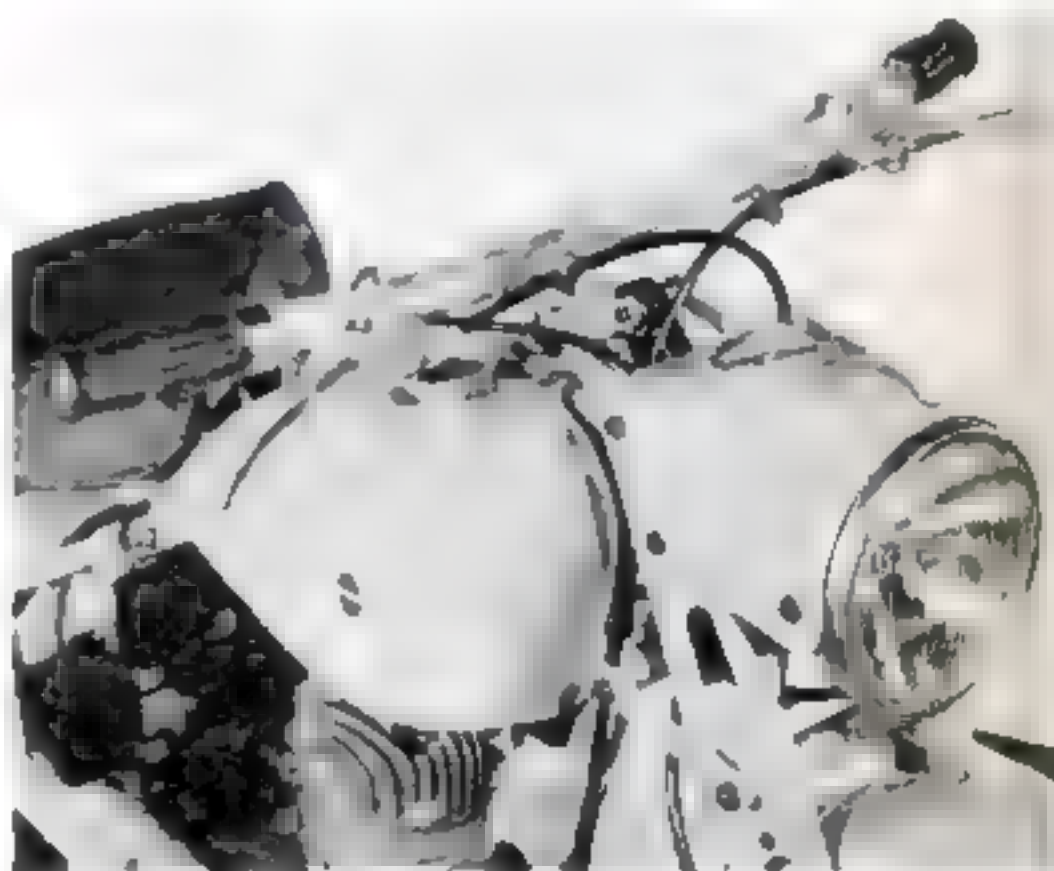
Parts on the left side operate in an oil bath. Shown above are the chain drive to the clutch sprocket, starter sector gear, and the spring that returns the shift mechanism to position.

SOMETHING new in American motor-cycles has just appeared—a two-cycle, one-cylinder Harley-Davidson with such features as a foot shift, handlebar clutch control, and foot-rest bar. Designated as the Harley 125 because piston displacement is 125 cc. (7.6 cu. in.), it weighs 170 lb. and sells at the factory for \$295 plus taxes.

Developing about 3 hp., the two-cycle engine has a compression ratio of 6.6 to 1 and an aluminum-alloy piston with dome head. Burned gases are removed by loop scavenging. In this system, incoming gases enter the cylinder by two ports placed tangentially, travel upward in a loop, and drive the burned gases out of the exhaust port. The engine is lubricated by adding 6 oz. of oil to each gallon of gasoline.

A transmission of the constant-mesh type provides three forward speeds. Operated by the clutch control on the left handlebar, a lever and worm inside the housing on the right side of the engine impart a transverse action to a clutch release rod that runs right through the main transmission shaft, disengaging the clutch. Shift action is transmitted through a shaft to a pawl. Since the shift mechanism is spring loaded, it returns to a central position. The clutch is the wet disk type with cork inserts.

The generator is attached directly to the crankshaft, and a cam on the end of the generator shaft drives the timer assembly. The battery is rated at 10 ampere hours.



Rubber springs at the upper part of the fork absorb road shock. Clutch, front brake, and throttle are operated by handlebar controls. Standard finish will be black with chrome trim.



Cigarettes Lighted for You

HERE'S a gadget that delivers lighted cigarettes to you while you drive. You need only reach over and pull out a small drawer in the lower section of a storage case mounted under the instrument panel. As you pull out the drawer, a cigarette drops into place and is pressed against a self-operated, fast-acting lighting element.

Measuring 2½" by 2½" by 3½", the case is made of steel finished in chrome. It will hold 20 cigarettes of standard size. The retail price is about \$5.



Control Feeds the Gas

ON LEVEL roads this control enables you to set the accelerator pedal for any desired speed—and then forget it. It consists of a ratchet and pawl that hold the pedal at the point of farthest depression until released by moving the foot to the left, the ratchet being mounted on a spring-operated hinge. If the brake is applied, the pedal also is released automatically by a safety cord. The device is a product of Automatic Accelerator Control, Inc., of Monroe, Mich., which has given it extensive tests.



Surplus Plane Tank Converted into Small Racer

ALUMINUM jettison tanks obtained from war surplus are used for the bodies of small racers that the E. K. Cargill Company, of Macon, Ga., plans to put on the market.

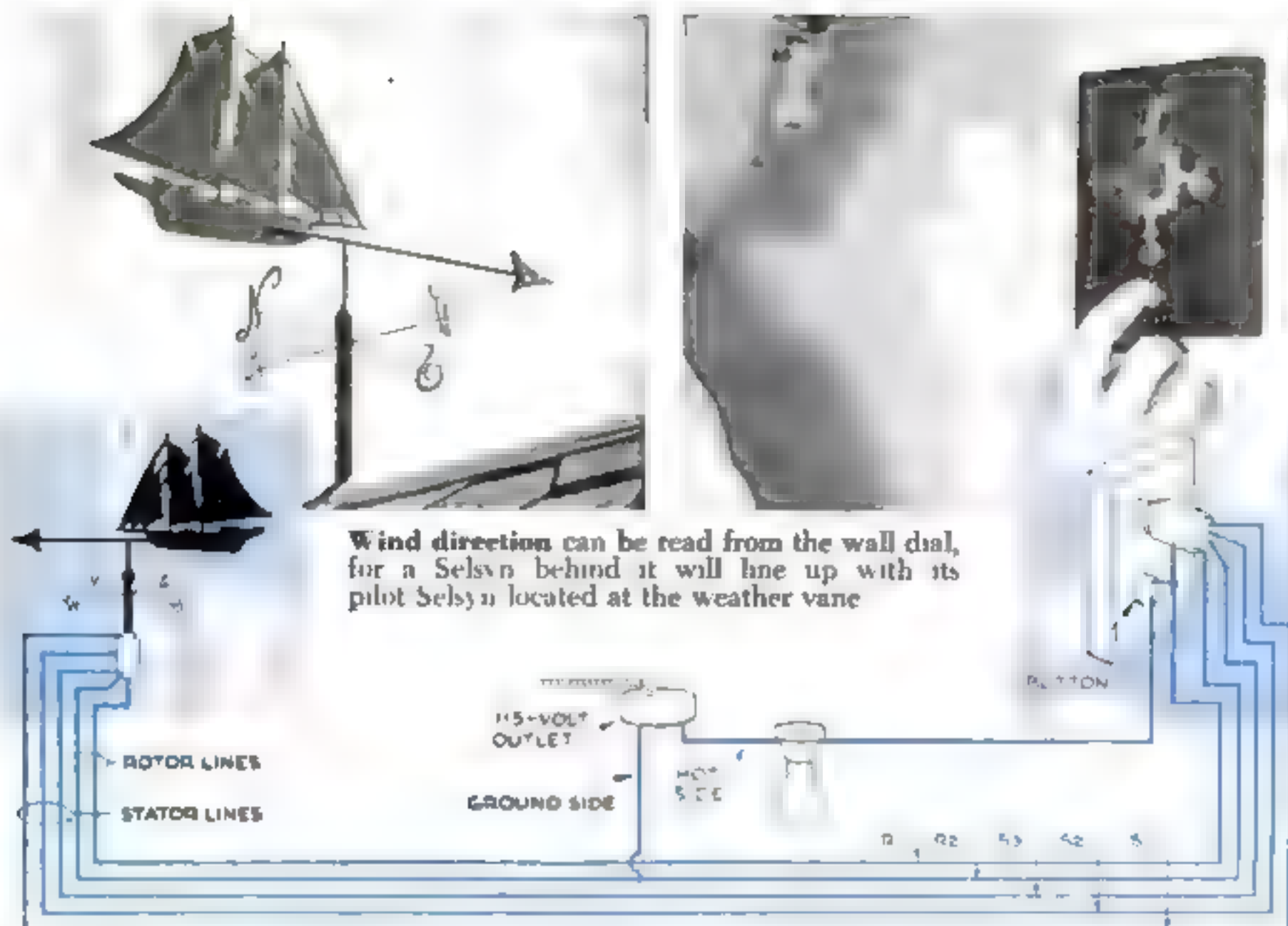
The racer is powered by a two-cylinder air cooled opposed engine that gives a speed

of 50 m.p.h. and does 75 miles on a gallon of gasoline. The chassis, differential, and transmission are of Austin manufacture, the fenders come from motor scooters, and aircraft wheels and seat are used. There's a large storage space behind the seat.

REG. U. S. PAT. OFF.



Electrified weather vane signals wind direction on indicator dial. See page 180.



Weather Vane Shows Wind on Indoor Dial

By Karl Grell

WOULD you like to stay snugly inside your home and see at a glance from what direction the wind is blowing—at any

time, day or night? This remote-reading weather vane will enable you to accomplish just that. At the touch of a button on a dial on your living-room wall, a pointer will report the wind direction outside.



Cut the ship and compass letters from sheet aluminum. Most other parts are made from brass.



Ball bearings are fitted into the ends of the upright. A brass cover protects the upper one.

Two Selsyn ® motors will do the job. When several of these war-born gadgets are properly wired in the same circuit, rotating the shaft of one will cause the shafts of the others to turn in exactly the same degree. Hence, if a pilot Selsyn is rotated by a vane atop the house, momentary application of current by means of a push button will line up a follower that operates an indoor indicator. This reading will then remain until the button is pushed again, enabling you to see whether wind direction has changed since the last reading.

Selsyns that will do the job are available as surplus for about \$3. Since only low torque is required, 400-cycle types will serve on 60-cycle lines if an appropriate ballast is used. However, avoid the type that can go 180 deg. out of phase.

Using metal-cutting blades, jigsaw the letters and ship from 1/16" to 1/8" sheet aluminum. Instead of scribing the metal, attach a full-size paper drawing to it temporarily with rubber cement. Make the first cuts with a 20-tooth heavy-duty blade, finish the outline with a regular 20-tooth blade, and cut out the interior with the latter blade and a small 32-tooth, using the slowest speed.

An 18" length of 1" brass pipe with a 1 5/16" outside diameter provides vertical support for the vane. Ball bearings in each end carry a 13/32" rod that couples the vane to a Selsyn in the attic below. After facing the pipe, bore it out until the bearings are a push fit. Any good 30-mm. bearings can be used.

For the roof mount, cut an oval 1 15/16" wide and 1 1/4" long in the center of a 2" by 10" rectangle of 1/4" brass, and drill four

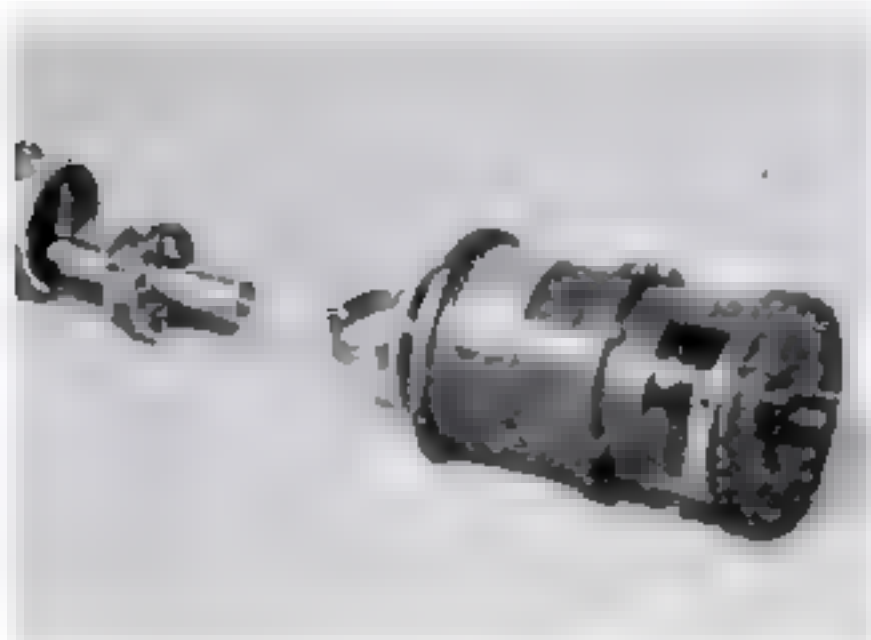
No. 11 mounting holes at the corner. Then bend the piece to conform with the roof pitch, slide it down over the brass pipe to about 8" from the bottom, and solder the joint.

Holding the pipe and bracket assembly as it will appear on the house, determine the direction of north with a compass, and scribe a vertical line on the pipe.

Measure 1 1/2" from the top of the pipe, drill and tap an 8-32 hole on the scribed north line, and repeat every 90 deg. for the other points of the compass. About 1" from the bottom of the pipe, drill and tap another 8-32 hole and insert a 1/4" round-head screw. This will allow the lower bearing to be oiled. Cut four 8" lengths of 5/32" rod, thread all the ends, turn into the four support holes in the pipe, and solder. Then screw the letters on the ends of the rods.

From a piece of 1 1/2" brass rod, turn down a flared upper bearing cover to the dimensions in the drawing, and drill to suit the shaft. Bend a 1" wide strip of .010" brass shim stock to serve as a weather skirt around the shoulder and solder well. Then slip the completed cover down over the end of the pipe and solder to the shaft, filing away excess solder to fair the covering into the rod. In the top of the shaft, file a concave groove to a 3/16" radius, drill and tap a 10-32 hole 1/2" deep, and drill and tap a 6-32 hole 1/2" deep into the bottom end of the shaft.

A 20" length of 3/4" aluminum tubing serves as the vane crossarm. Slot one end to receive the ship as indicated in the drawing. With the ship in the slot, drill two No. 29 holes to clear roundhead 6-32 screws. Also drill a clearance hole for mounting the



Brass shim stock bent to an elliptical shape couples the vane shaft and the pilot Selsyn.



An arrowhead is molded by pouring molten lead into a form jigsawed in a block of 1/2" wood.

shaft, and mount it loosely with a round-head brass 10-32 screw.

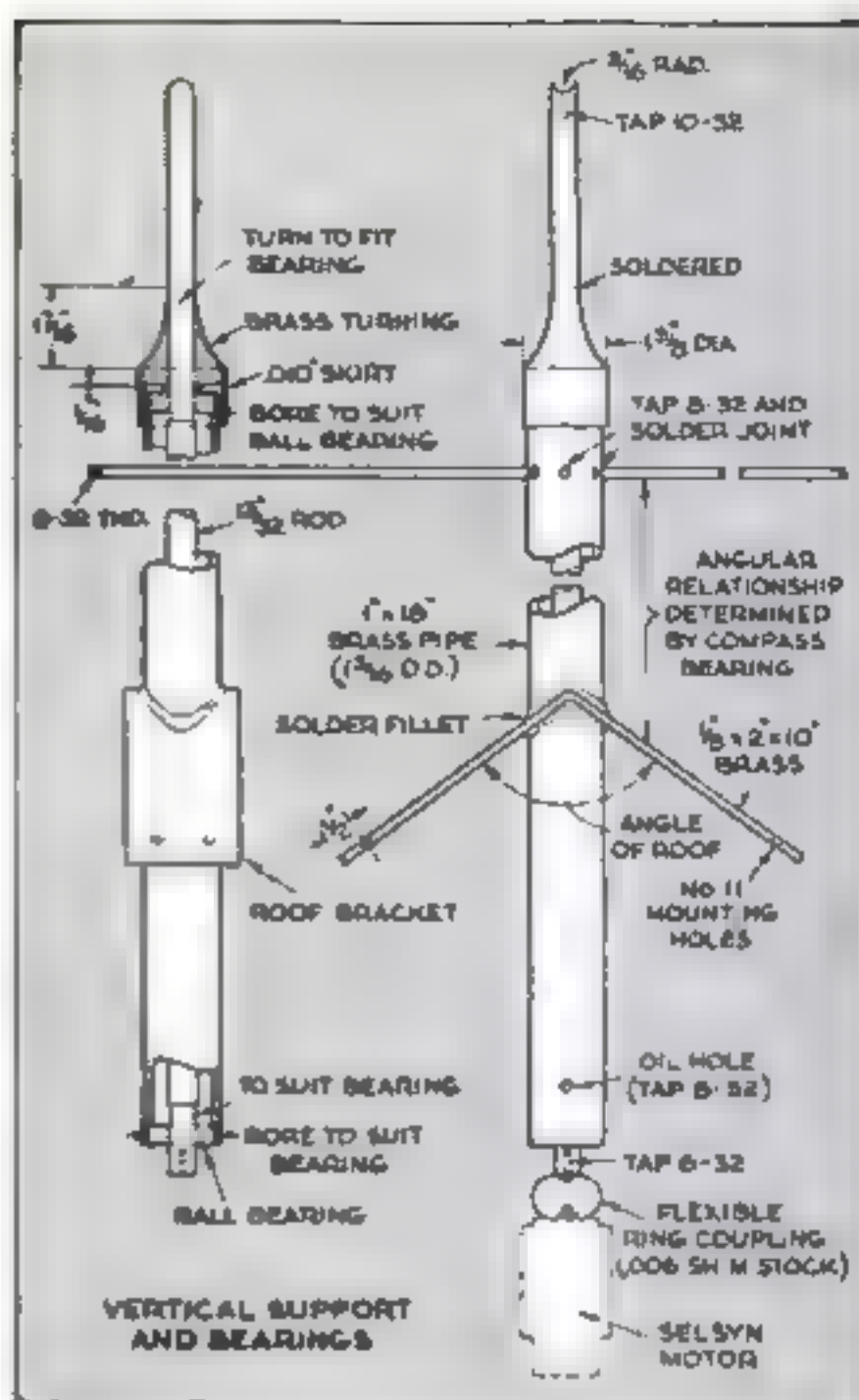
Now clamp the brass pipe vertically in a vise and hang strips of sheet lead over the pointer end of the crossarm until the weight counterbalances the ship. Add another $\frac{1}{2}$ lb. to this lead and put it all in a ladle.

Transfer the arrow pattern to a piece of $\frac{1}{2}$ " scrap wood, jigsaw it out, and nail wood over the bottom. This will serve as a mold. Elevate the end slightly so the point of the arrow will be thinner than the base. Heat the ladle with a blowtorch, and pour the lead into the mold.

Drill a $\frac{1}{8}$ " hole 1" deep in the completed arrow to receive the crossarm. With the assembly clamped in the vise, slide the head back and forth until the arm balances. Then drill and tap the head for a 6-32 brass locking screw.

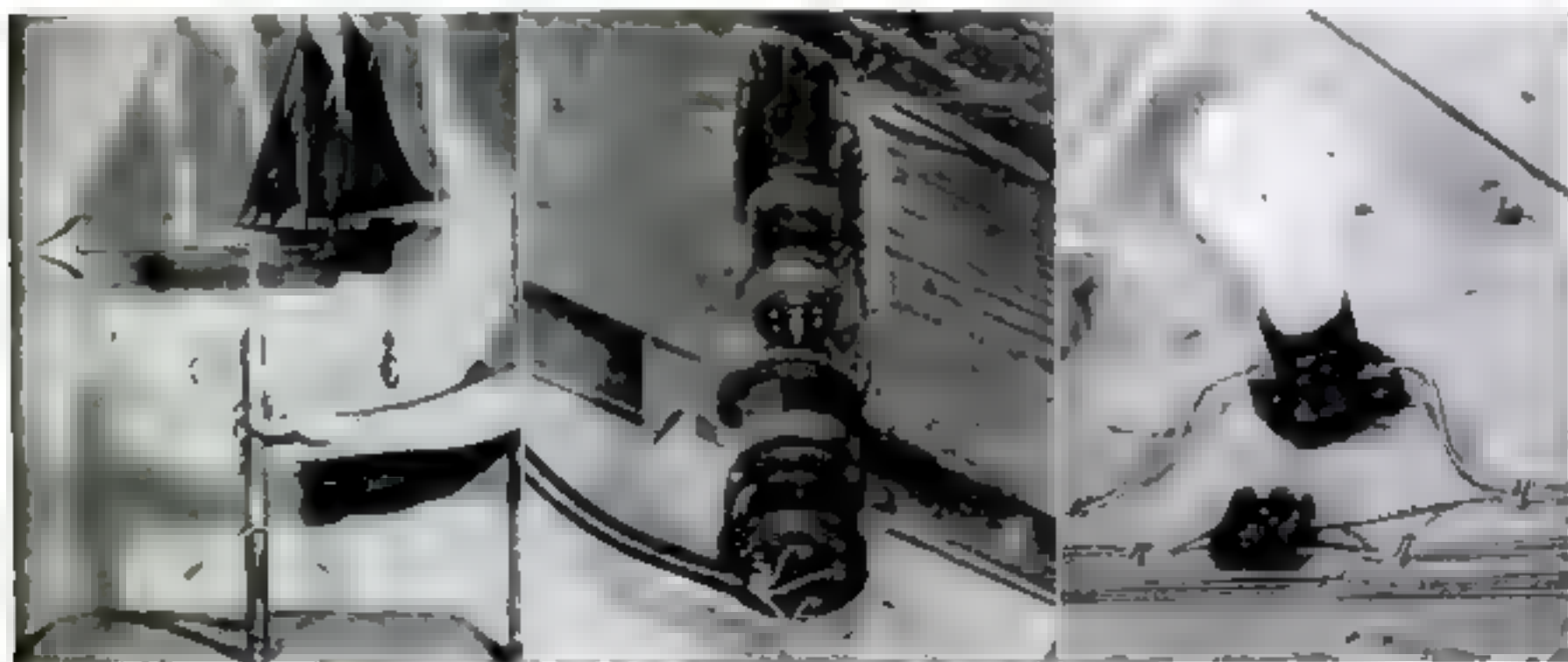
After painting the assembly, cut out a small circle of roofing at the point where the vane is to be located and bore a $1\frac{5}{16}$ " hole. Put the pipe down through, coat with roofing cement or tar, seat the bracket, and screw it down.

A flexible coupling for the shaft and Selsyn may be made by bending a $\frac{1}{8}$ " by 3" strip of .006" brass shim stock to elliptical shape. Drill a hole in each end and in the center. Put a roundhead screw through the center hole into the bottom of the shaft. A nut holds the ends together on the threaded Selsyn shaft. Secure the brass pipe and Selsyn to a stepped wood mount with pipe straps and a metal strap as seen in the center photo below. Put a dab of paint on



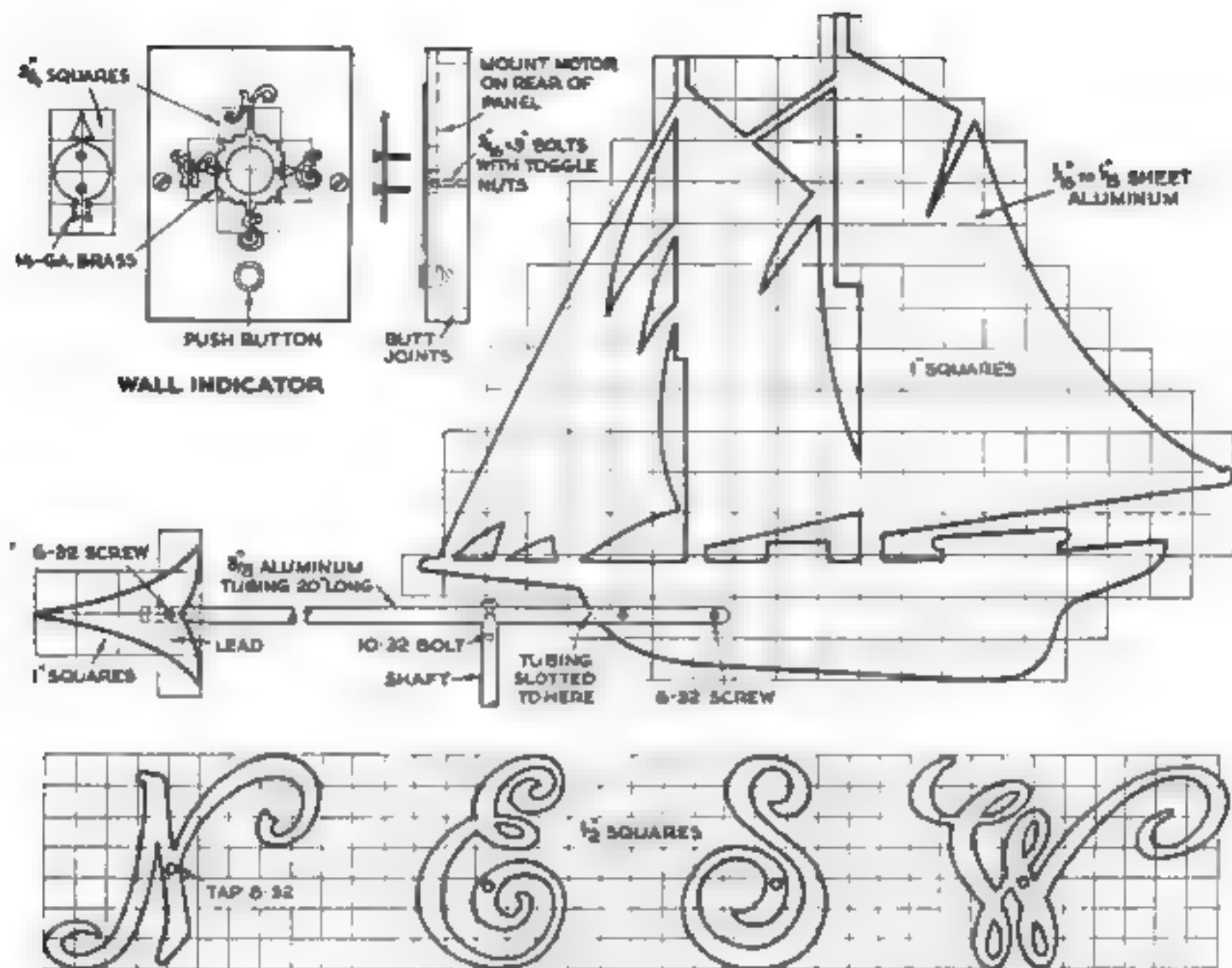
the end of the shaft and coupling so the vane will not have to be reoriented when taken apart for oiling.

Cut the pointer and compass rose for the wall indicator from 14-ga. brass. Letters for the rose may be copied exact size from the drawing. Drill and countersink for flat-



When the vane is complete, bore a hole down through the roof and mount the pipe and pilot Selsyn on stepped wood blocks underneath. Put

a 60-watt bulb in the hot side of the 115-volt power circuit as ballast and lead the ground to one side of the rotor terminal block as above.



head brass screws, buff to a high luster, and coat immediately with clear lacquer to prevent tarnishing.

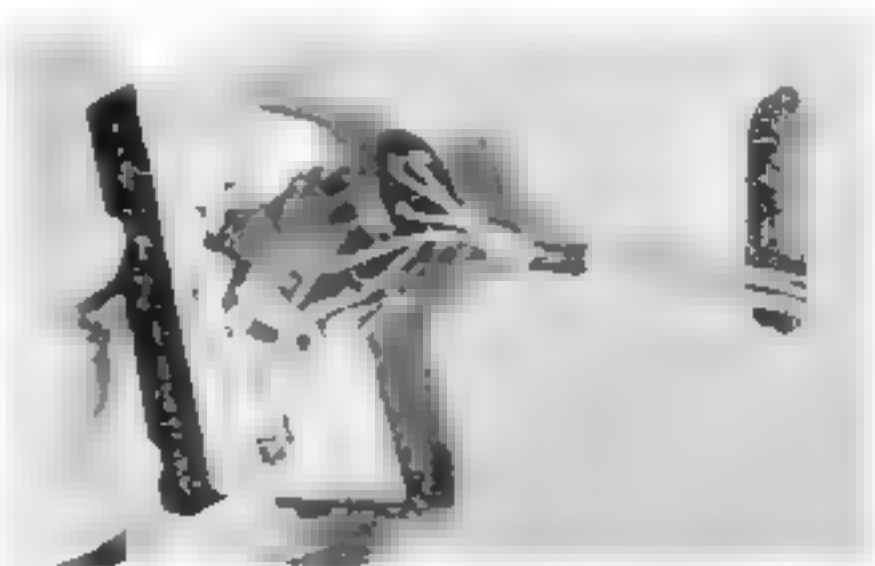
The plaque itself is simply a shallow box with the Selsyn follower mounted on the back with four clips. The box must be deep enough so that the remaining length of the Selsyn can be accommodated in the wall. Mount a doorbell button in a $\frac{1}{2}$ " hole bored in the face of the plaque, and cut a clearance hole to pass whatever kind of pointer-shaft coupling is practical for your Selsyn.

Five wires of any convenient size are required to connect the two Selsyns, two for the rotors and three for the stators. The rotors are wired in parallel and draw about .5 amps at 56 volts. A 60-watt bulb in series with the hot side of the 115-volt power line serves as a ballast for the rotors, the lamp being lighted only when the button is pressed to read the wind direction. For safety reasons, the ground side of the house circuit should be connected to the rotor terminal block. The hot side then connects only to the bulb and push button. Solder the wires to the Selsyn contact pins.

To orient the indicator with the vane,

have someone stand outside and call the heading of the vane. After loosening the four clips, rotate the entire Selsyn, with the push button depressed, until the pointer reading is the same as that of the vane.

The bearings in the vane unit should be oiled every six months, or oftener if the moisture or salt content of the air is high. To oil the top bearing, remove the screw that holds the flexible coupling to the shaft. Then go up on the roof and pull out the shaft, invert, and apply oil. **END**



Mount the plaque over a hole cut in the wall after orienting the pointer with the wind vane.



Storybook Birdhouse



Here's a birdhouse that's different, a bit of fantasy right out of the pages of Grimm and Andersen.

By Karl Grell

YOU can give your workshop a rest from square corners and nicely jointed edges with this unusual project, patterned after the illustrations in children's storybooks. It's made mainly of soft pine, which should be fairly free from knots since there is considerable shaping to do.

Using the squared drawings, lay out full-size views of the house, roof, windows, and tree. Trace the rear view twice on $\frac{1}{2}$ " stock (front and back are identical in outline). Sides are also identical and should be cut from 5" by 6" pieces. Jigsaw all four walls according to the pattern, and glue and nail them together. Bevel top and bottom edges of the sides to conform with the front-view drawing, and round the four corners to about a $\frac{1}{4}$ " radius.

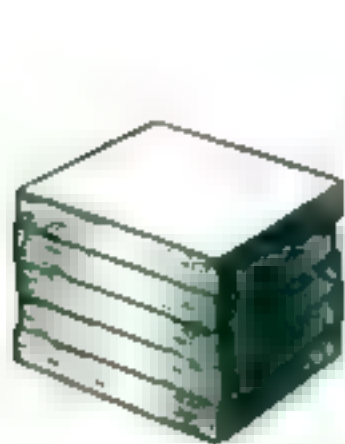
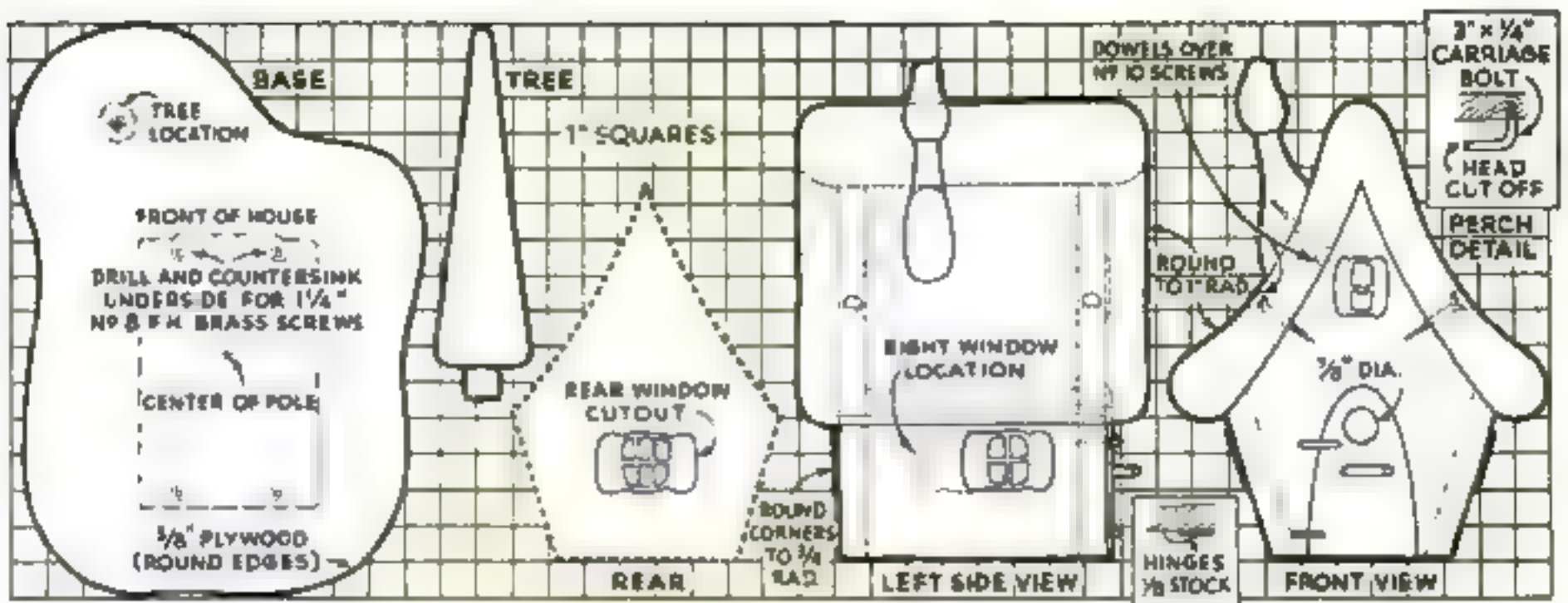
Jigsaw the windows, door, and hinges from $\frac{1}{2}$ " outdoor plywood or similar stock, cutting openings for the windowpanes and the entrance. The latter, incidentally, should be just large enough to admit the

species of bird you expect to take up residence. Glue and tack the plywood pieces in place.

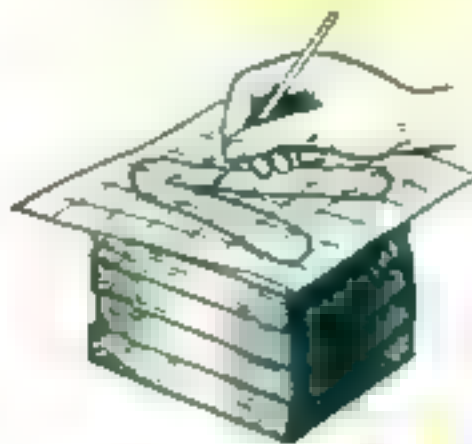
The roof is probably the most distinctive feature of the whole project. It is made by gluing up several pieces of 9" by 10 $\frac{1}{2}$ " stock to a total thickness of 10". If you have access to a 10" bandsaw, you can cut them all in a single operation; if not, glue as many as you can manage at one time. After cutting and gluing are completed, round the outlines with knife, rasp, and sander.

On a 1 $\frac{1}{2}$ " by 1 $\frac{1}{2}$ " by 6 $\frac{1}{2}$ " block, trace two views of the chimney and jigsaw or carve it to shape. Mount it with glue and a 2" screw from inside the roof. The roof is also fastened with glue and counterbored screws. A carriage bolt, shaped as shown in the detail, serves as door handle and perch; the tree can be either turned or carved from a 2 $\frac{1}{2}$ " by 2 $\frac{1}{2}$ " by 10 $\frac{1}{2}$ " block.

Jigsaw the base from outdoor plywood and round the edges. Sand all surfaces as smooth as possible. Apply two coats of shellac, and three or four of good lacquer or enamel, following the color scheme shown above or improvising any variation that appeals to you.



GLUE UP



TRACE ON



BANDSAW

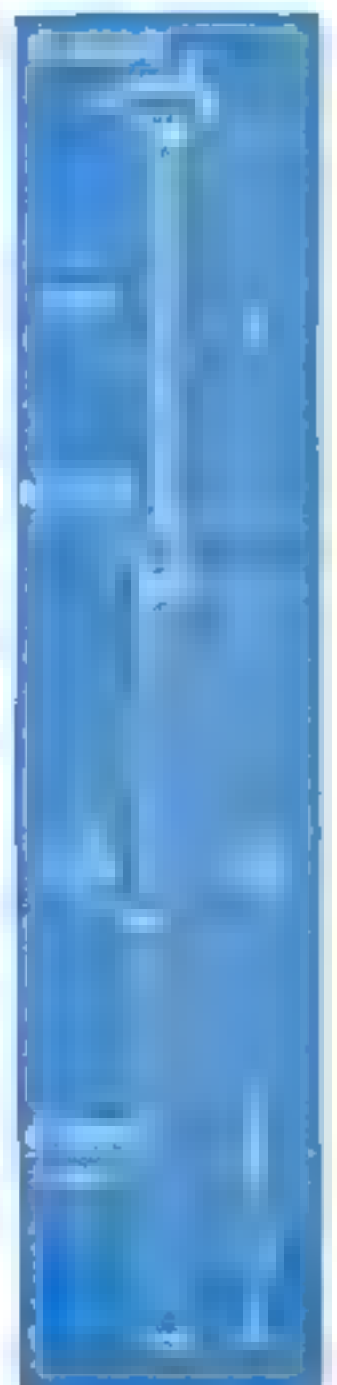


ROUND EDGES

MAKING ROOF

Bolt a pipe flange to the bottom of the base, screw on the house (don't use glue; you may wish to take it off for cleaning), and it is ready for tenants. Unscrew the house and take it in for the winter, and when you do, grease the pipe threads to prevent rusting. A plug in the end of the pipe will keep water out.

Enlarge the outlines of the birdhouse parts onto large sheets of paper and saw and carve the various pieces. It isn't necessary to duplicate all shapes and dimensions exactly so long as the parts fit properly. Paint the house and base separately. Mount the unit on a flanged pipe



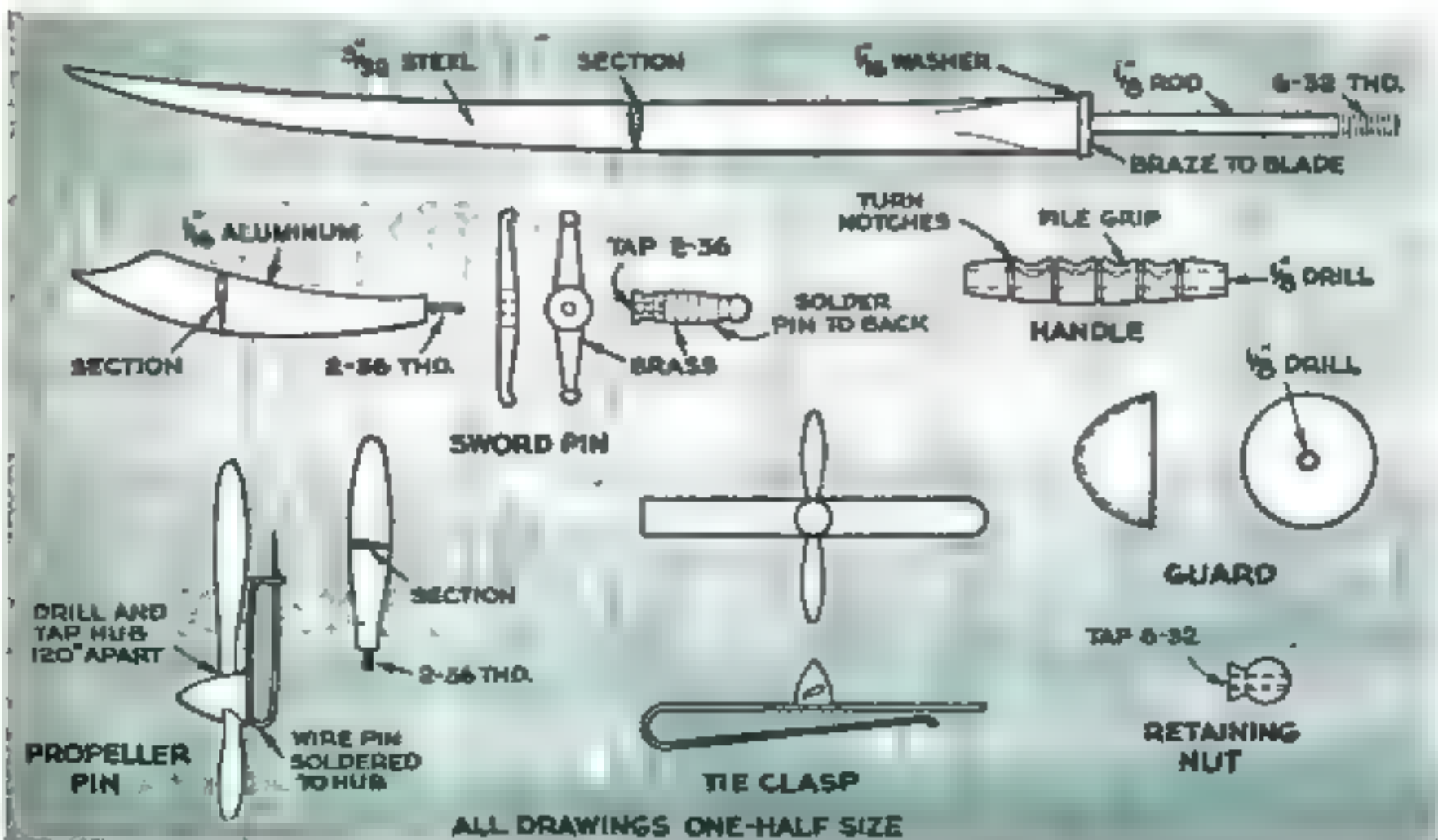
Handmade Miniatures You Can Wear

By John J. Harper



THESE gleaming metal miniatures make perfect gifts for somebody special, because they represent painstaking craftsmanship on your part. The small sword and three-bladed propeller are distinctive lapel pins, but the

sword is readily made as a tie clip instead. The steel-bladed letter opener is a striking desk ornament. A metal-turning lathe is convenient for forming the sword handles and prop spinners, but if you are a good



hand with a file you can do without it.

For the sword pin, I used a scrap of 24 SO aluminum for the blade and bits of brass for the handle and guard. Because finish is important on such pieces, use first emery and then crocus cloth to remove all file marks and impart a polish. The pin in back, soldered to the brass, can either be a small safety pin or a shaped and sharpened piece of piano wire.

The propeller lapel pin is also easy to make. I filed the blades from 3/32" aluminum, leaving a short round shank at the root of each for threading into the hub. This was turned from stainless steel and drilled and tapped with three holes 120 deg. apart. Like the other pieces, it was buffed to a high luster and then lacquered.

A strip of stainless-steel sheet is the clasp part of the tie pin. The hub was turned from drill rod and drilled with two small holes at 180 deg. to take the stub ends of the brass blades, which are soldered in place.

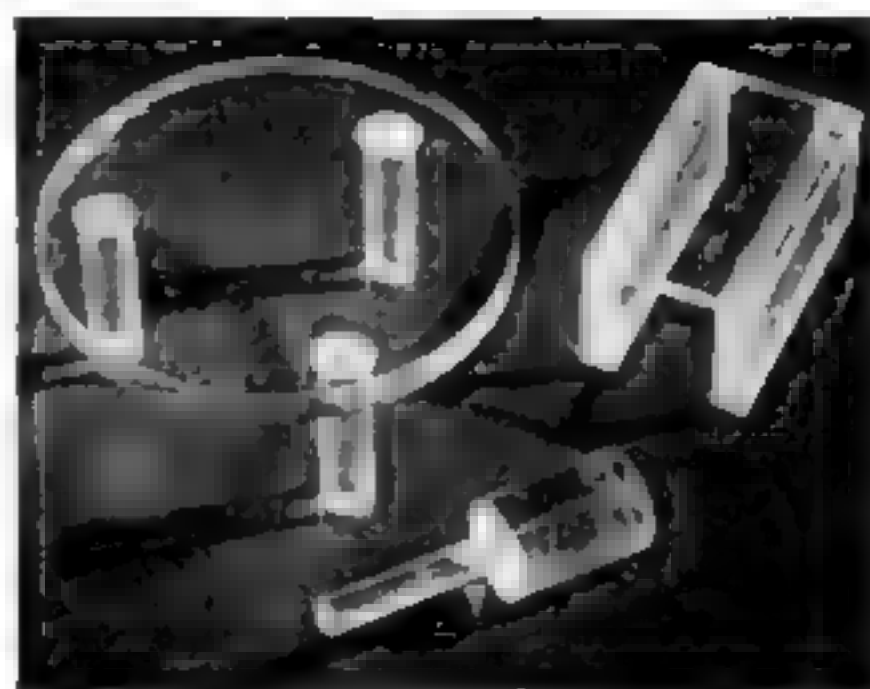
Though a slightly more difficult piece, the letter opener is well worth the effort. I used a piece of ground flat stock for the blade, hardening it after shaping, but some aluminum alloy 3/32" or 1/8" thick would do almost as well. If you use aluminum, remember to leave a long tang that can be threaded for the handle. The curved guard was spun on the lathe from some soft aluminum tubing, though it might equally well have been filed from brass. After assembling the piece, inspect it carefully for file marks, and then polish, buff, and lacquer it.

Plastic Pins Make Invisible Welds

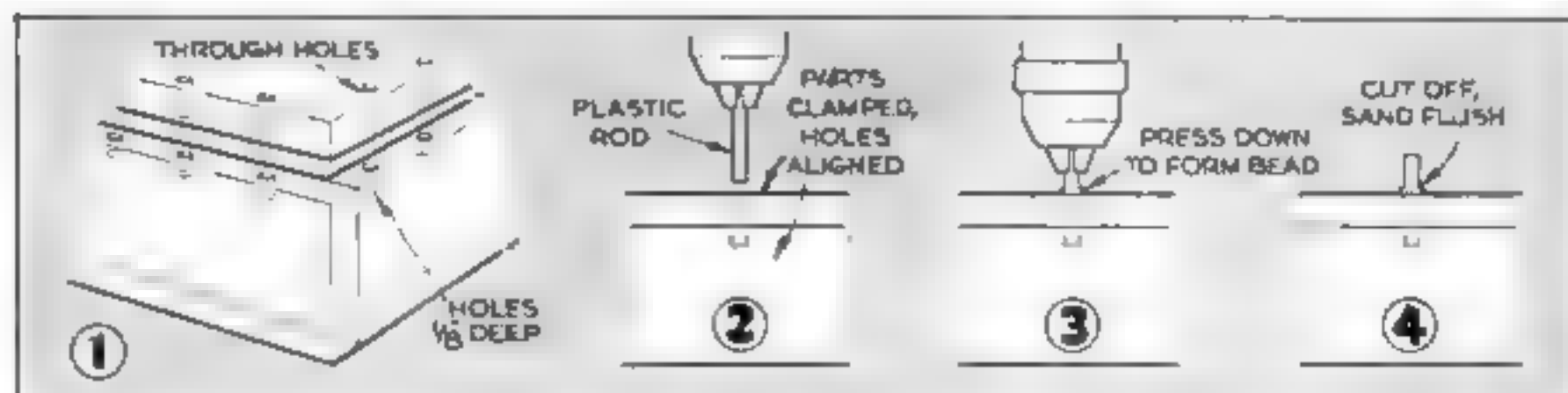
A TRICKY method of assembling clear-plastic pieces, using neither cement nor screws, is to hold them together with plastic dowel pins that are fed into predrilled holes while rotating rapidly. The pins are practically invisible since they melt into the adjoining material. The technique is useful for joining rods to flat stock (as in the miniature coffee table shown), for joining pieces of flat stock, and for connecting different diameters of round stock.

To make an assembly such as that in Fig. 1, lay out and drill holes in the work, which should be clamped to assure perfect alignment. The holes need not penetrate more than 1/8" or 3/16" into the lower pieces. Next chuck a plastic rod in the drill press, of the same diameter as the lead holes or slightly smaller, and adjust the belt to drive the spindle at its maximum speed. With the rod spinning, feed it down into the hole (Fig. 2) until you strike bottom, and continue to feed slowly

The rod will melt under pressure and friction and the hole will start to fill up.



The moment it has completely filled, stop the spindle as quickly as possible and press down lightly until a small bead forms at the surface of the work, as in Fig. 3. Hold the rod there until the plastic hardens (approximately a minute) and then release the rod in the chuck. Repeat the operation on all holes, and then cut off the stubs (Fig. 4), finally sanding, polishing, and buffing the surface.—KENNETH W. JUDGE.



Squaring Stock by Hand



Continuing the series on woodworking methods, this article tells how to get around an edge.

By Edwin M. Love

TRUING and surfacing one or both faces of a board—discussed in two previous articles—is the first step in readying the board for use. But before you can consider the stock as having graduated from the rough to the finished class, you have to square and smooth the ends and edges. Start

with one edge; if it is damaged or crooked, place a straightedge far enough in to clear the defects and draw a pencil line along it. Depending upon the amount of waste to be cut away, you can rough to the line in any one of a number of ways.

Saw to the line if possible. If the strip to be removed is too narrow to support a rip saw, use a draw knife as shown in Fig. 1. Work with the grain, take short strokes, and keep one handle a little ahead of the other. Should the blade dig in, rock it back on the bevel slightly to avoid cutting below the





line. Change the pulling direction to suit the direction of the grain. The edge of the blade may be kept keen by holding one end against a bench stop and whetting the bevel with circular strokes of an oilstone (Fig. 2).

Lacking a draw knife, cut to the line at intervals and pare away the waste with a chisel as shown in Fig. 3. Another useful

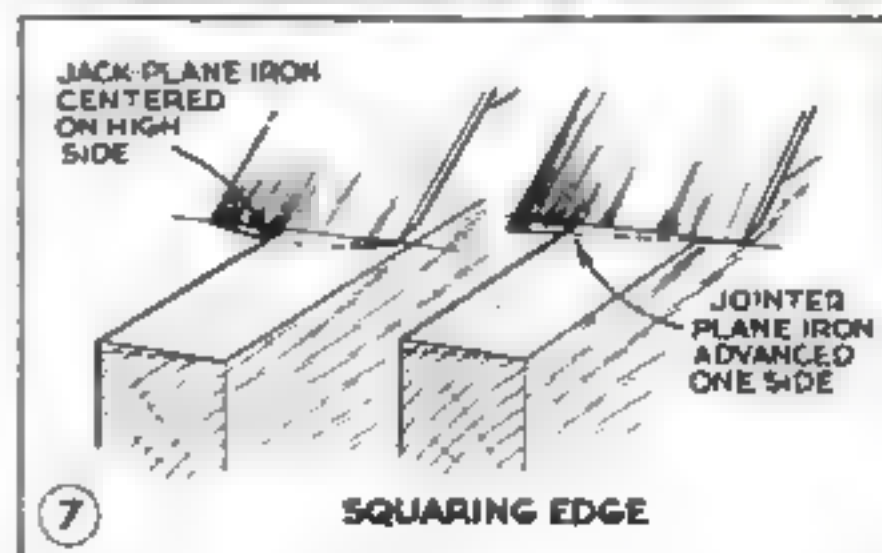
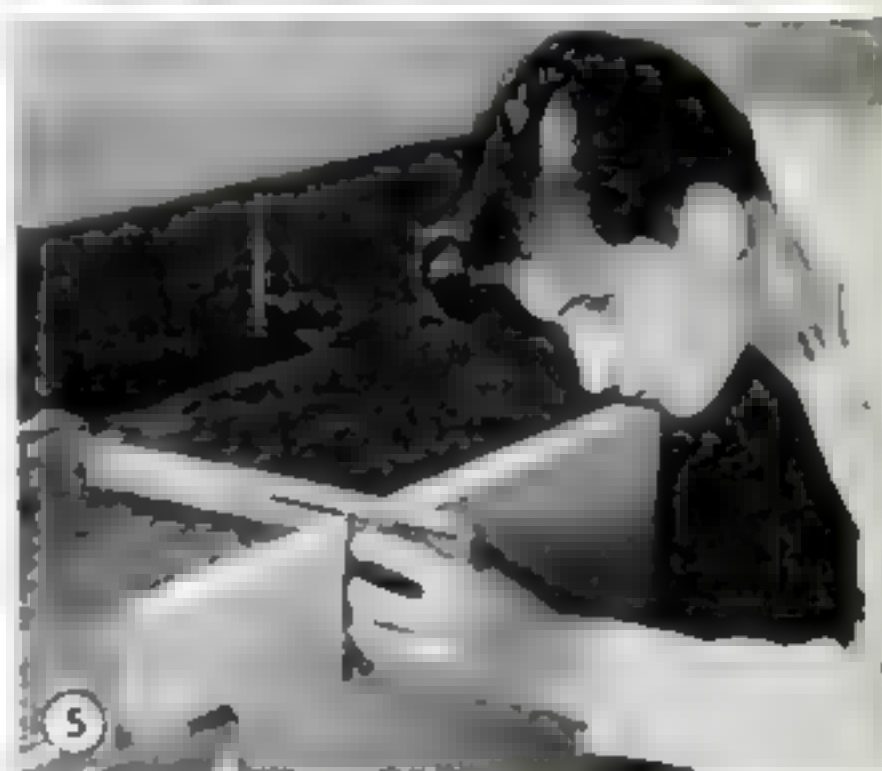
tool for roughing is the jack plane. As in surfacing, you must avoid dropping the heel of the plane at the beginning of a stroke, or the toe at the end. Lift it clear after each stroke, but instead of gripping the knob with the left hand, hook the thumb around it and guide the plane by sliding the fingers along the face of the board (Fig. 4). Since the jack-plane iron is crowned (Fig. 7), the stroke can be centered on the high part of the board edge.

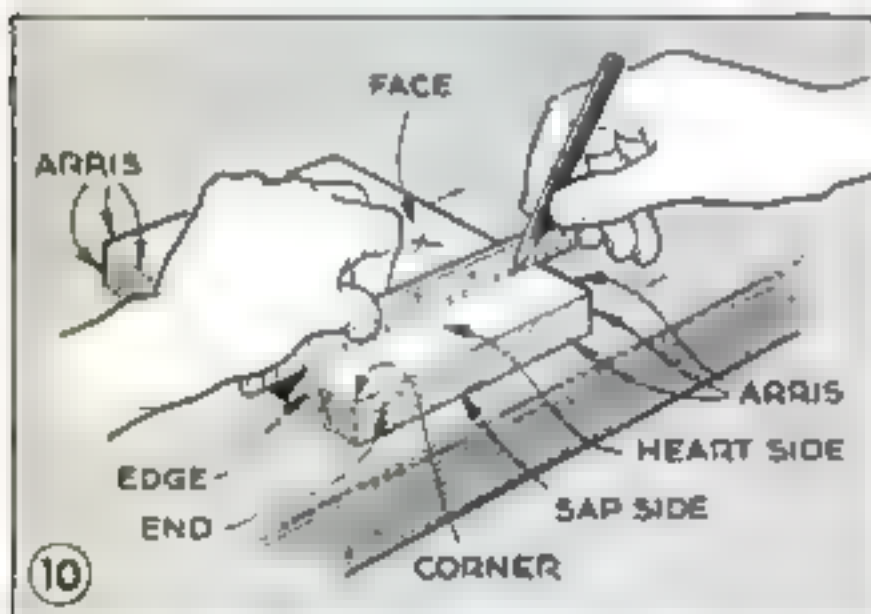
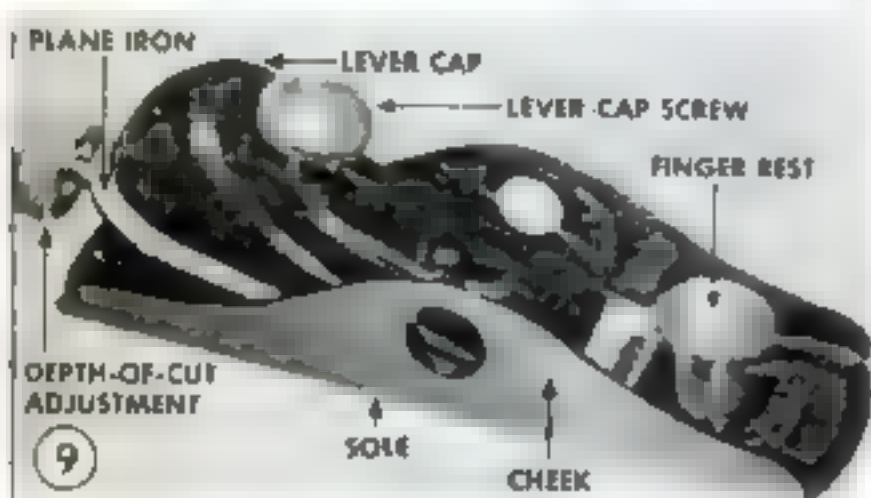
Having roughed to the line with saw, knife, chisel, or jack plane, you are now ready to get down to the fine job of truing. Test the edge with a try square or an adjustable combination square—a much more useful tool—by pressing the handle against the face of the board and looking for light between the edge of the piece and the blade (Fig. 5). If the board is small, hold it at eye level for inspection.

Finish truing the edge with a jointer plane or smooth plane. Its long sole rides high spots that are too far apart for the jack plane to span. Since the edge of the iron is straight rather than crowned, centering it to one side does not correct an edge that is out of square. Instead project one corner of the plane iron toward the high side by moving the lateral-adjustment lever toward the opposite side. Fig. 7 shows how this will cause it to cut a thicker shaving at one side.

When the wood is cross-grained, a stroke or two of a smooth plane—made full length—is effective in smoothing rough spots. Plane and check with the square until the edge is perfectly true, and then mark this edge so that you can use it as a working base for squaring the ends and taking width measurements.

Lay the square across one face of the





board, as in Fig. 6, so that you can mark off an end exactly at right angles to the squared edge. Draw a line far enough in to clear defects and irregularities. For rough work a heavy pencil line will do, but when accuracy is wanted, a sharp, hard pencil or the point of a knife should be used. Saw off any sizable waste. Smooth the end with a plane held as in jointing (squaring an edge) but at an angle for cleaner cutting. Continuing the stroke of the plane blade beyond the far edge will cause splintering unless the edge has been beveled with a chisel. Both the bevel and the proper method of holding the plane are clearly shown in Fig. 8. If there is not enough width to allow beveling, plane toward the center of the end from both edges. Test for squareness with the face side and the trued edge.

Because of its low-set iron, a block plane (Fig. 9) cuts particularly smoothly on end grain. Depth of cut is regulated as in other planes, but side adjustment is made by loosening the lever cap a little and shifting the iron. Sharpen the iron to a straight edge, dub off the corners to keep them from scratching, and clamp it in the plane with the bevel up.

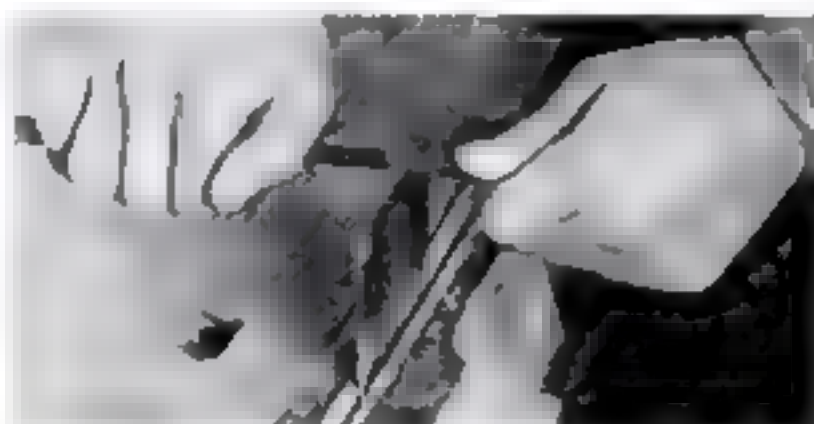
Some of the more common terms relating to a board are illustrated in Fig. 10, along with a recommended method for taking accurate measurements. The latter consists of holding a rule on edge with the division marks against the wood, and, since the end of the scale may be worn off, it is projected beyond the edge so that the 1" mark can be used as zero. Use a sharp pencil or knife for marking off measurements.

Several methods are commonly employed for laying out the width of a board. If it is rather wide, measure the finished width at both ends and connect the points with a



line drawn along a straightedge. Often a combination square can be adjusted to span the board as in Fig. 11. The blade can be adjusted for width, and the square is then drawn along the face of the board in the direction indicated by the arrow, while it guides a pencil or other marking device. If the width is not too great, a marking gauge can be used in the same manner.

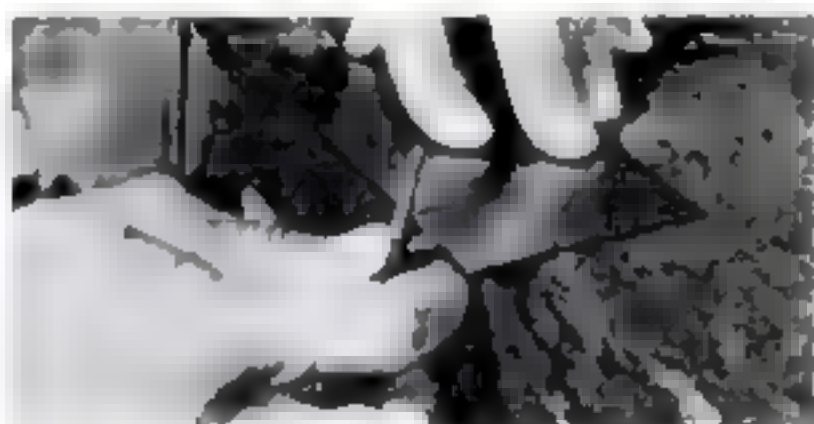
The final operation in squaring a board is to bring it to thickness. Set a marking gauge by measuring accurately the projection of the pin on the beam. Hold the gauge as shown in Fig. 12, and, rolling it forward to engage the pin lightly, press the head against the face side. Plane the board to the line. True the surface if both faces are to be exposed. [TO BE CONTINUED]



Draw-filing the edge of a scraper blade. Move the file back and forth, keeping it at right angles with the blade faces. Deburr the sides with the file held flat



Burnish the edge by laying the blade on a bench and stroking it flat with a piece of round hardened steel. A punch or nail set works well. Oil or wax it lightly



Turning the edge. First stroke the edge with the burnisher held at right angles; then tilt it in a trifle to form a small cutting burr on each of the faces.



Correctly sharpened, the scraper turns up a shaving on hardwood. On fir, shown here, shavings are cut from the hard grain, but crushing soft grain produces some powder.

Sharpened Scraper Readies Wood for Sanding

MOST hard or cross-grained woods are better prepared for sandpapering if they are first scraped to remove plane marks and other rough spots. A simple scraper blade will do the job nicely, and it is one of the easiest tools to condition.

Clamp the blade in a vise and draw-file it with a flat file. Bring all the edges straight and square, and make the arrises sharp. Remove the burr by rubbing the file flat against the sides. Round the corners slightly. Hone the edges with an oilstone held at right angles, and rub off the burr again.

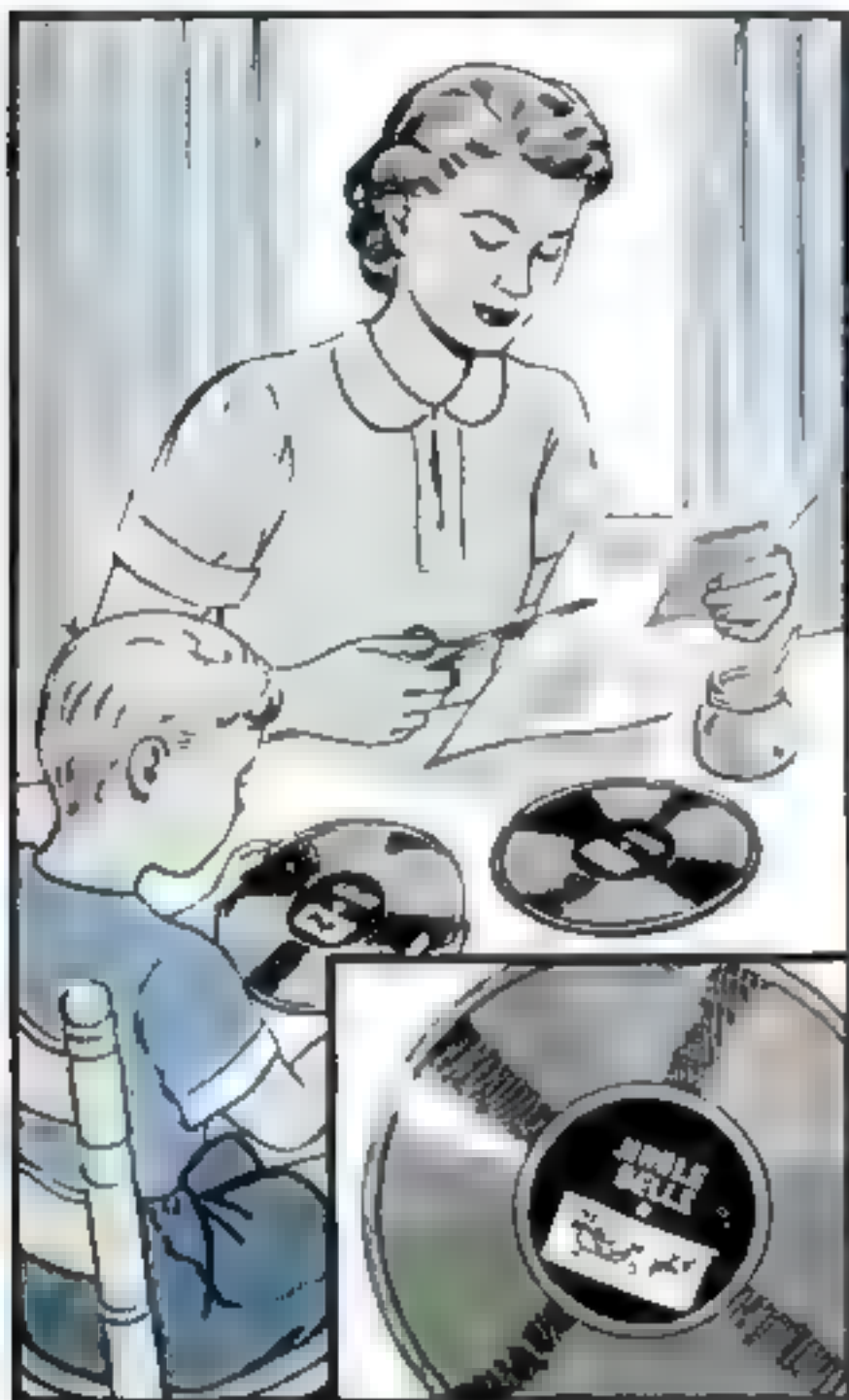
Next lay the blade on the bench and rub the side with a burnisher, which can be any piece of round, hardened steel

such as the side of a nail set or punch. Follow this by stroking firmly along an edge with the burnisher held vertical. Gradually decrease the angle to about 85 deg. The slight burr turned toward the face enables the scraper to cut smoothly. Repeat until all eight arrises have been made sharp and turned down very slightly.

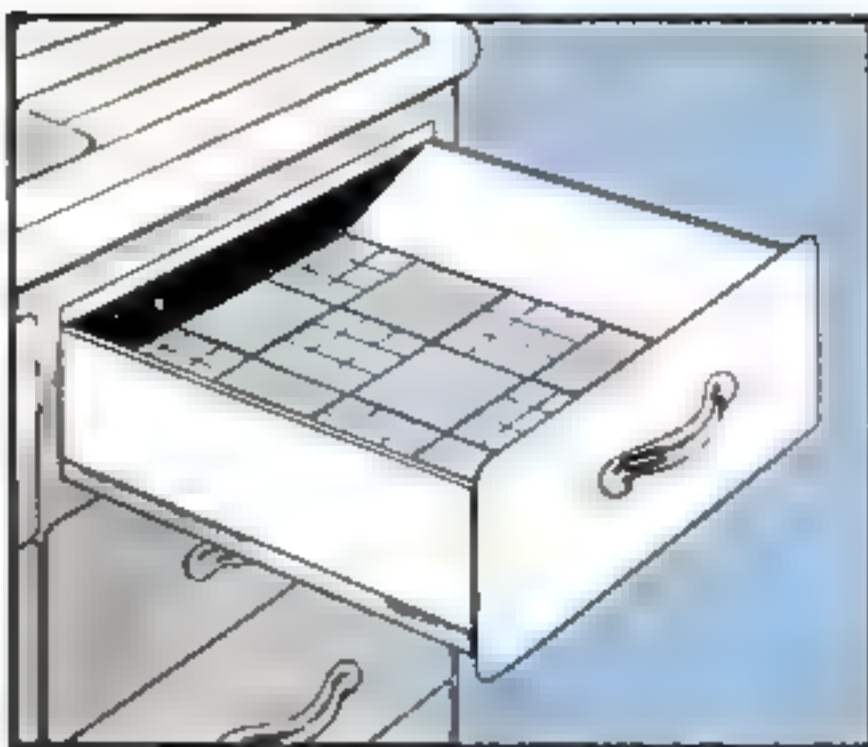
In use, the scraper is inclined until an edge begins to cut. Push or pull it, and keep shifting the stroke on the wood to cover evenly. When the scraper dulls, it can be reburnished two or three times before it becomes necessary to refile the edges. Sometimes a reburnished blade works better than one that is newly filed.



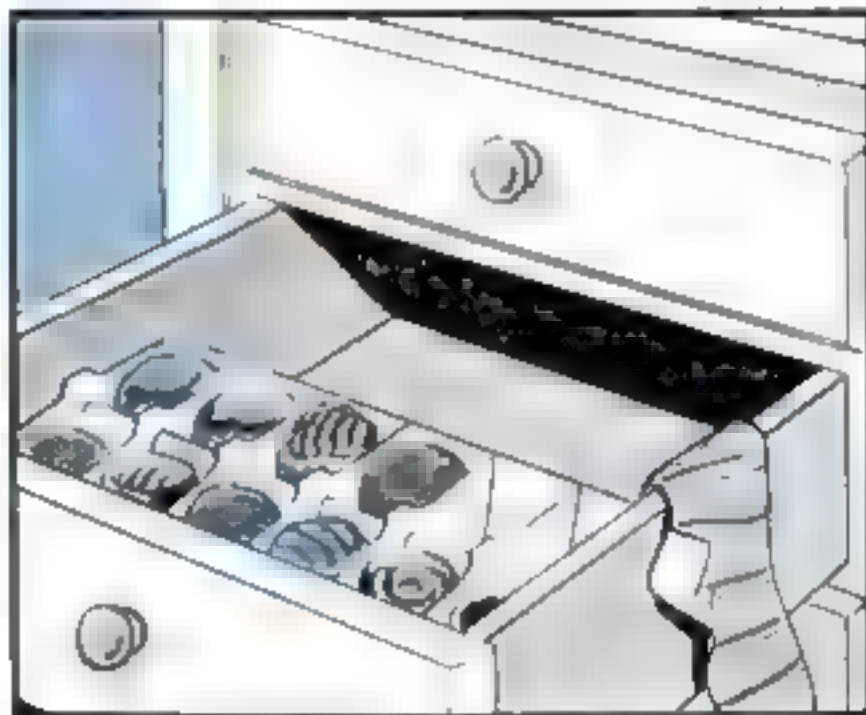
KEEPING THE HOME SHIPSHAPE



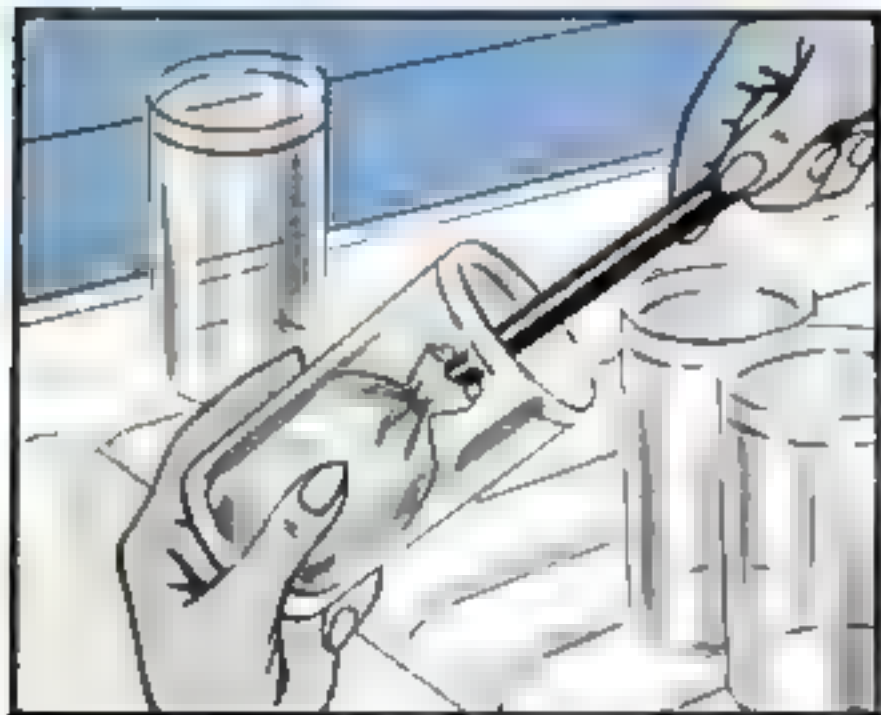
Pictures on records will help a young child who is unable to read to select the one he wants. Illustrations that will suit the titles often may be found in juvenile books.



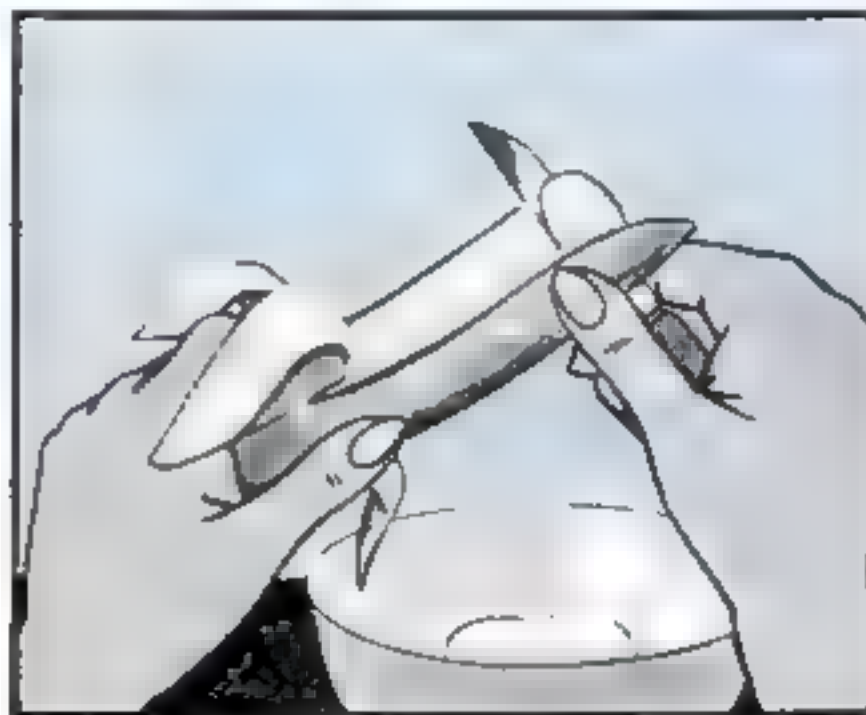
Linoleum fitted into a cutlery drawer deadens the noise of knives and forks being returned to place. Use scraps left over when you next put down a new covering on the kitchen floor.



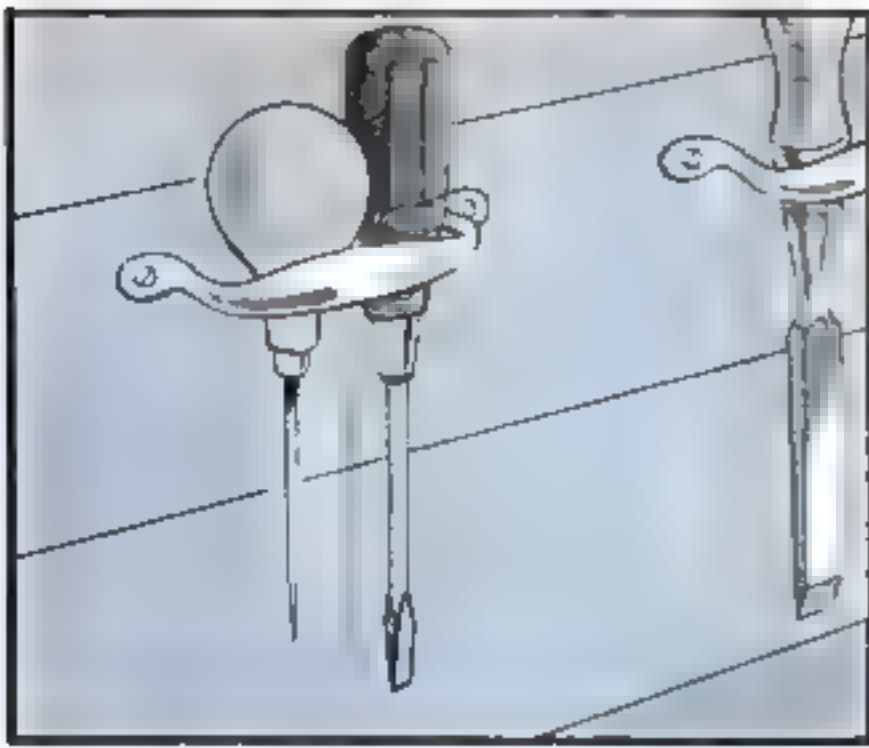
An egg carton in the dresser drawer provides handy compartments for orderly storage of a young child's supply of clean socks. Selection of the desired socks then becomes easier.



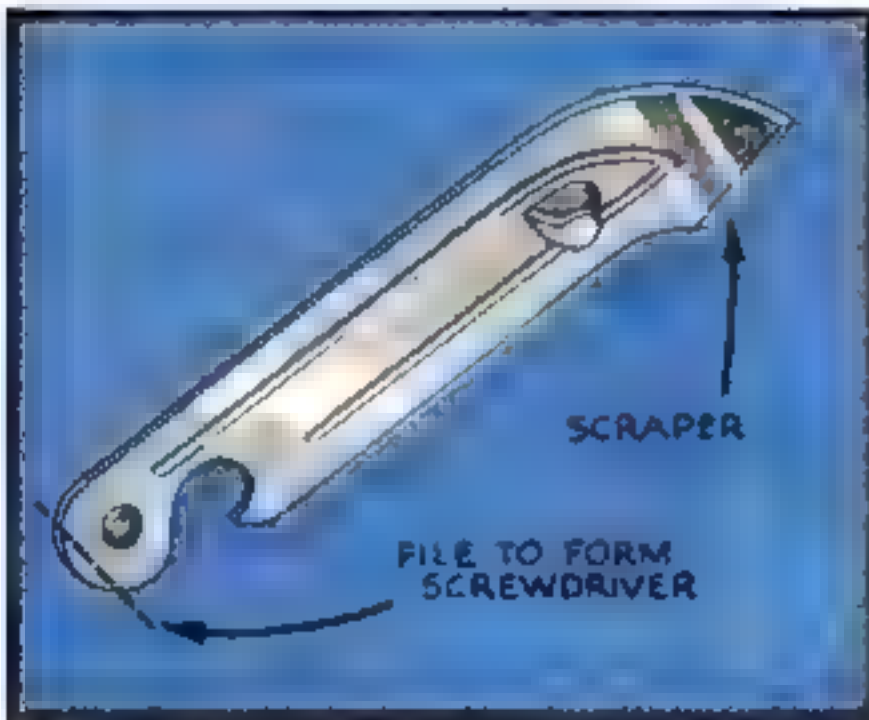
Tall glasses may be dried inside with a dish mop adapted for the purpose. Cut a piece from a torn dish towel, wrap it up around the mop head, and secure with string or a rubber band.



To slice a banana without touching it with the fingers, peel it down all around except for a narrow segment. Then hold the banana as shown and cut against the remaining strip of peel.



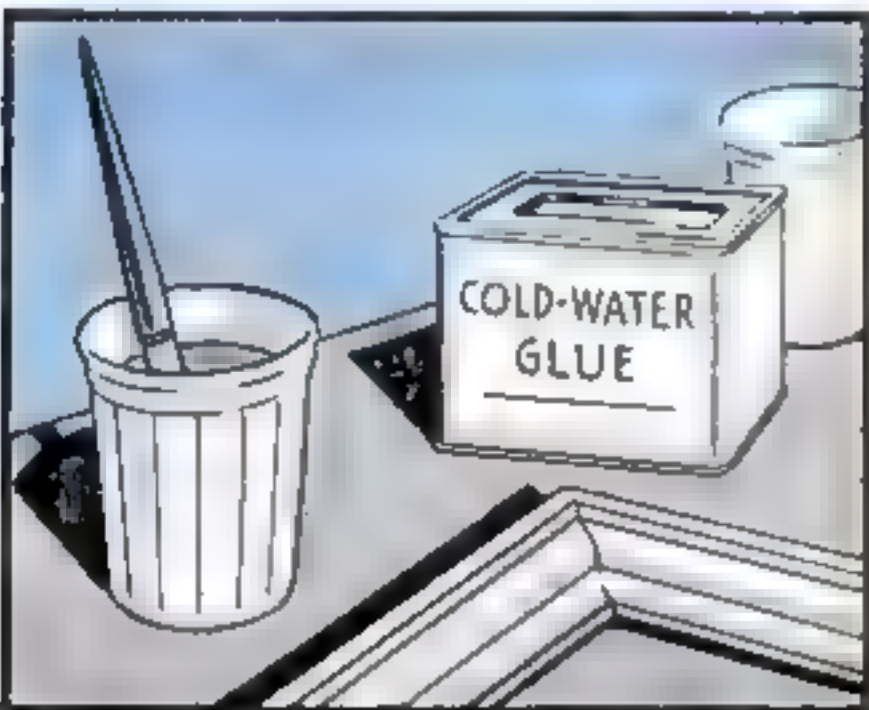
Drawer handles attached in a tool cabinet or over a workbench make excellent tool holders, and they're quickly installed. Several of your smaller tools may be kept in each holder.



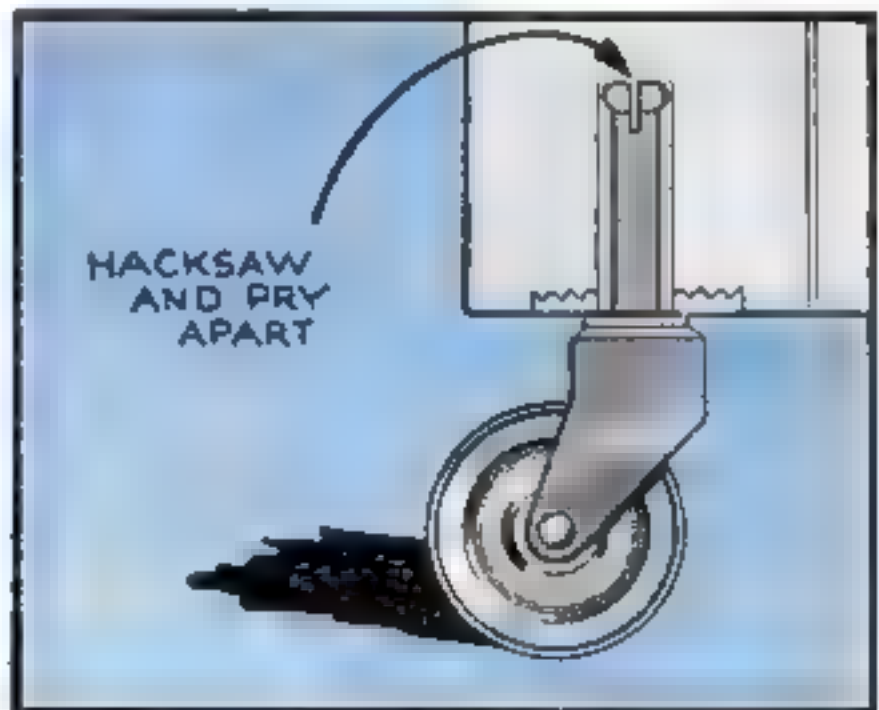
Beer-can openers have many uses. For instance, the point makes a good scraper for cleaning out corners and may be used to apply putty. Filed off, the handle serves as a screwdriver.



Irregular surfaces may be thoroughly sanded with a sheet of abrasive paper formed around a rubber sponge or piece of sponge rubber. The paper will conform to most moldings.



Paper drinking cups make excellent containers for mixing small amounts of cold-water glue. Inexpensive to buy, the cups can be discarded after use. The 3-oz. size is probably best.



Castors that fall out if a piece of furniture is lifted may be kept in place by this method. Hacksaw a slot about $\frac{1}{4}$ " deep in the end of the caster post and wedge the cut slightly apart.



A horizontal spice box is one of my projects. It was copied from an 18th Century original.



Handsome of all my pieces is a wall shelf with two drawers. It's one of my latest jobs.

***No skill... No fancy tools...
No blueprints... BUT...***

I'm Proud

By Jerome Parker

FROM the little mounds of sawdust and wood shavings that litter my floor has just emerged a reproduction of a nine-drawer 18th Century spice box. It's crude—but I'm proud of it.

The spice box is the latest piece I have completed in a long-term project of making replicas of early American furniture. At present count, the finished jobs add up to ten—a miniature cradle, a table, pipe box, scone, wall box, two vertical spice boxes, one horizontal spice box, and a wall shelf. The tenth? Well, that was an experiment, and the less said about it the better.

Since I possess just about enough manual dexterity to tie my shoelaces, no one has been more pleasantly surprised at this success than myself.

All Built from Scratch

I built these objects from scratch; that is, I didn't follow any blueprints or directions. If there was a design to be followed, I simply traced it freehand on the board. Or if the design was a little tricky, I drew it first on a piece of paper and then transferred it to the board with carbon paper.

My tools? My modest array would make

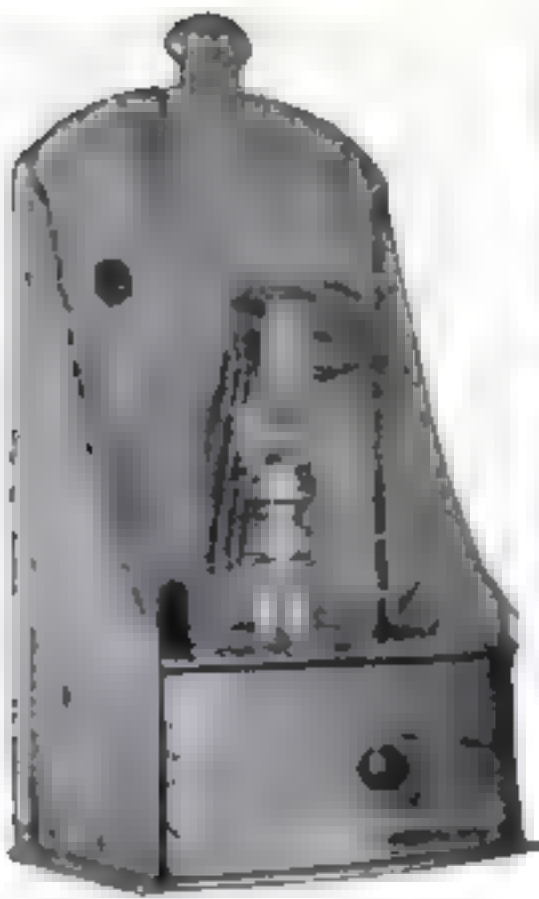
a fine craftsman wince. But however few, or however wrongly used, they did the work for me. At present I have no workbench, but I'm thinking of making one. After all, why do things the hard way all the time? To set up shop, I just haul out two sawhorses, sit on one, and saw on the other.

Simple Tools Do the Job

I put together my first real job, a wall shelf and drawer, with a saw, hammer, nails, and pins. I used sandpaper—but not enough, for I was in a hurry to see what it would look like. Nevertheless, it looks fine and is still holding together. Except for staining, the piece was completed in one afternoon.

Since then I have acquired other tools, but not nearly as many as the sawdust seers say I should have. On my latest jobs I've used a square, saws (crosscut, compass, coping); plane, rasp, and file; also nails, sandpaper, and glue. Any shop veteran will tell you that's still a slim budget of tools for turning out even a birdhouse.

However, I'm learning—and I'm going to buy more tools, a backsaw, block plane, an assortment of chisels, and a spokeshave as a starter. And one of these days I'd like to pick up a lathe—so I can turn out legs as pretty as my wife's.



A bow front made as in the sketch on page 197 sets off the drawer of this colonial scone.



House plants now grow in a miniature cradle that I cut out and assembled in a few hours.

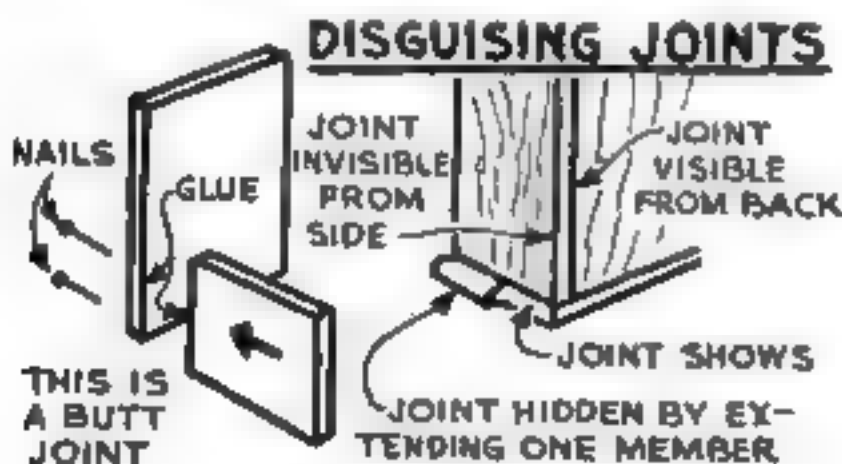
of My All-Thumbs Craftwork

By now you've probably guessed that the Parker woodworking method is a path filled with pitfalls. But it gets the beginner going, and you learn a lot by trial and error. Any suggestion that you must have a full tool kit and a lot of manual ability can easily throw you for a loss. It did me until recently.

The same with plans. To me they're a waste of time. If you want to make an object that will serve some really useful or decorative purpose around your home, go and take a look at a similar specimen that's already built, or study a photograph or sketch (not a blueprint!) of it. Then set to work and make it. There's no reason you should be stymied by lack of experience.

Here's how I got started. Our home is furnished along early American lines, my

wife and I both being fond of the sturdy colonial designs. We have one genuine old piece, a spinning wheel. Our other furnishings are the most tasteful adaptations and reproductions we could find. To add to them is a problem, for genuine antiques are very expensive and so many of the slick



Getting the legs even on this table gave me a bit of trouble—but I finally got 'em just right.



Like the original, this wall box boasts a hinged lid and a single drawer.

Opened out, the lid is seen as a T-shaped piece that rests on pins run through slots on the end-pieces. The face of the drawer overlaps slightly.

and custom-tailored reproductions are wholly unsatisfactory. A polished, glistening commercial cobbler's bench, for instance, throws an early American room entirely off tone.

Unable to get what we wanted, I decided

that perhaps I could make some colonial reproductions to brighten our scheme. My wife was skeptical.

Well, the results weren't perfect—far from it—but we're mighty pleased with them, and I'll stack the articles I've made against some of the real thing. The scars, nicks, and accidental lopsidedness of some of my pieces make them just so much the better. I'm not slipshod, however, and the absence of elaborate tools means that I must work just that much harder.

Ideas Gleaned from Magazines

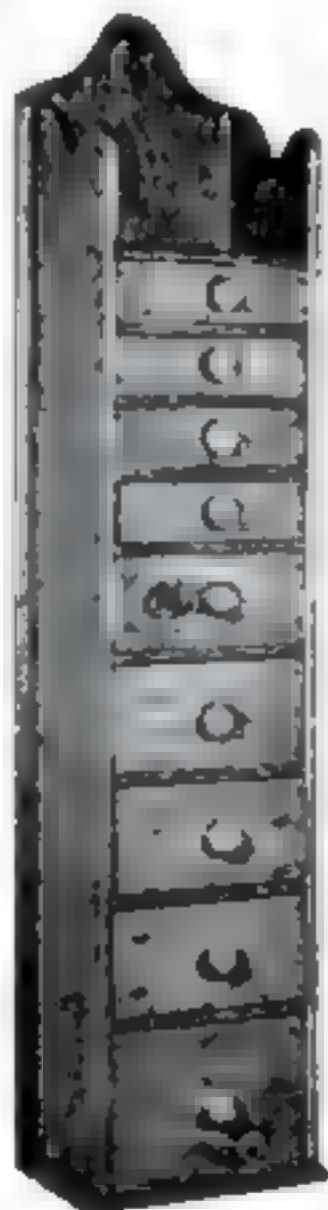
My initial inspiration came from leafing through the pages of various magazines. I looked mostly for the small advertisements of companies and craftsmen that produce modest colonial replicas—spice boxes, wall boxes and shelves, spoon racks, chests, and small cupboards. There were many things that it seemed I might be able to make. I steered clear, however, of anything that would serve just as another cigarette container. I wanted my things to have a deeper utility than that.

Most of these advertisements are illustrated, and the dimensions usually are listed—not all of them by any means, but you can figure out the rest yourself. It may surprise you to find what you can accomplish just working from a photograph.

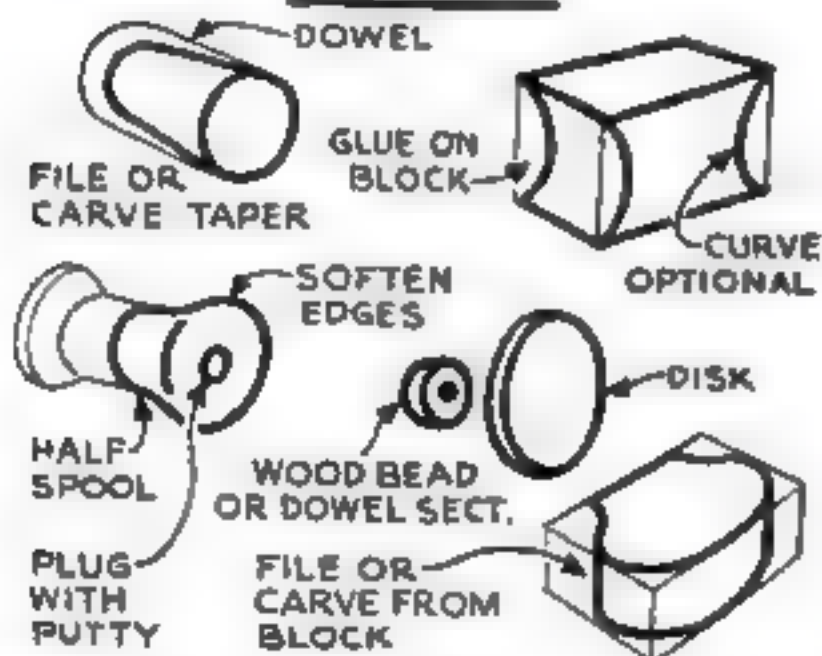
Along with checking through magazines I visited a library and studied various handbooks and encyclopedias of early American furniture, mainly those illustrated with lots of photographs and sketches. Although I admired the chair, table, and cupboard designs, I knew they were not for me to follow—just yet. Instead, I pored over the pictures and descriptions of the pipe, wall, and spice boxes, the wall shelves, dough troughs, and sundry other small items, taking notes and making sketches of the designs that interested and pleased me.

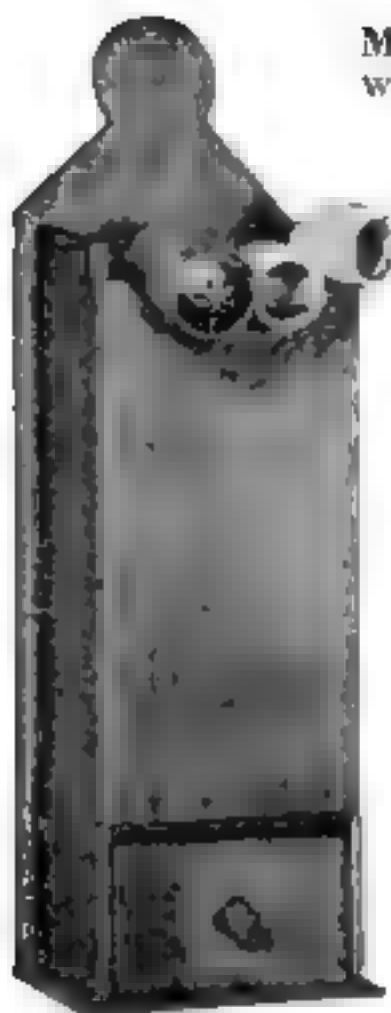
In the library books I

Nine drawers made this tall spice box quite a task.



HANDLES





My pipes find a home in a wall box with fishtail back.

also found much useful data on the construction and finish of colonial pieces. The way they are joined, for instance, was all new and fascinating to me, for I never had used anything except a butt joint—the joining surfaces flat against each other. I still use only this simple joint, but sometime I'm going to attempt a mortise and tenon, and maybe a dovetail. For my purposes, however, the butt joint is perfectly

satisfactory. Modern glues on the surfaces and nails driven through one member into the end of the other yield a surprisingly strong joint. The nailheads can be set and covered over with putty to be less noticeable.

I've also extended my research to the department stores and the antique shops. In this way, you can examine the old-time pieces thoroughly and see at first hand how they were put together and what designs were used. One of these days I'm also going to make a few visits to a museum or two with the same plan in mind. Whatever I see that I like will go into my sketchbook to be translated into wood later on.

The projects illustrated on these pages were all designed from originals made somewhere between 1700 and 1780. I'm not going to give any dimensions for these unless the editor forces me to.*

For these pieces I used either $\frac{1}{2}$ " or $\frac{3}{4}$ " stock, the choice being mainly dictated by the size of the article and the wear it would get. The wood was anything I could get. The hard-luck stories you encounter at lumber yards these days become pretty tiresome, but if you hang on long enough you usually can get what you want. I used to tell them what I wanted the wood for, but they had alibis to thwart all my plans. Now I browse for myself and take what looks good to me. Usually I'm not disappointed. I've used pine and cedar so far, and a couple

of times, when I was stuck, even some pieces from apple and orange crates.

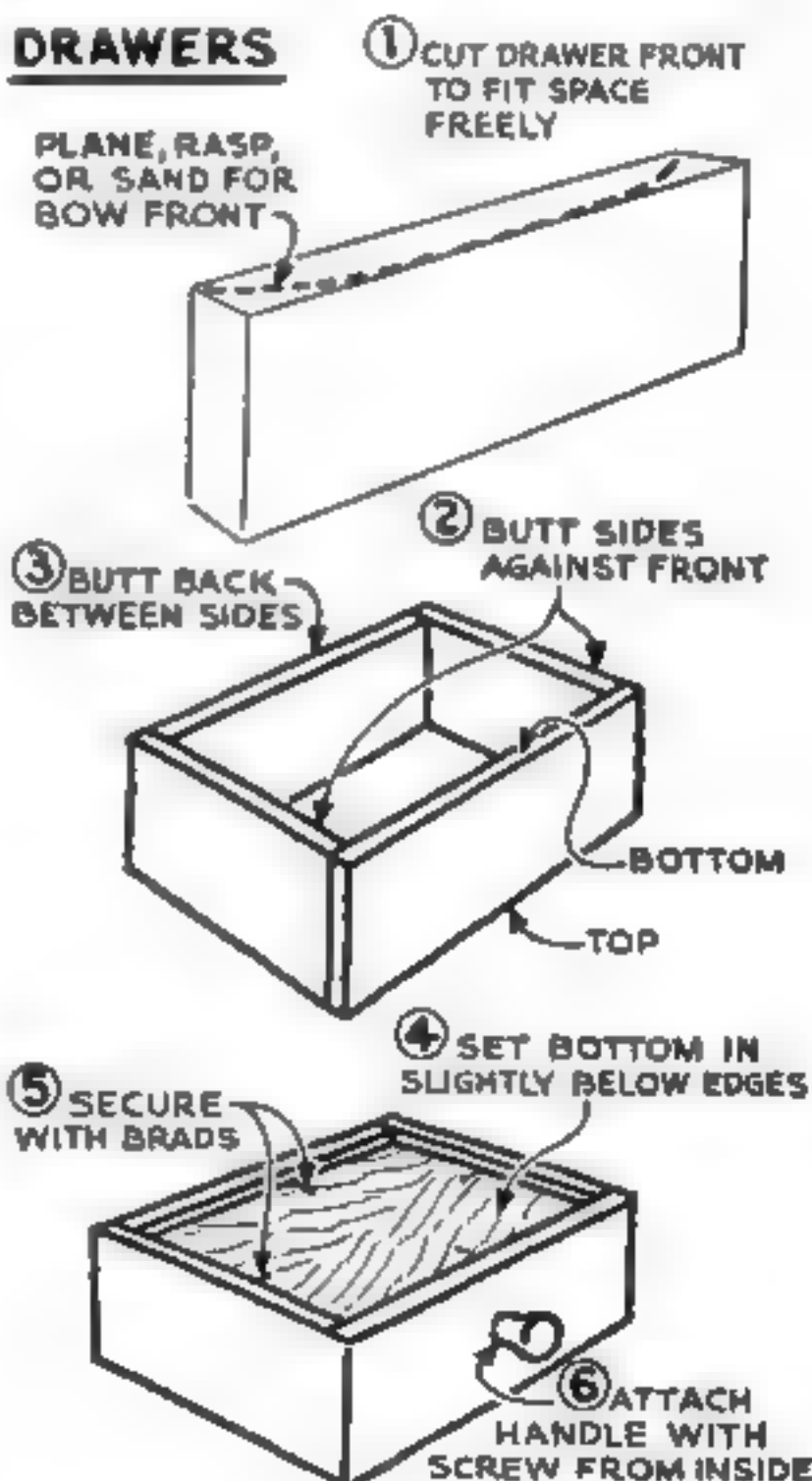
I finished all my reproductions with pine oil stain, then applied shellac, and finally waxed them. I made some of the drawer knobs from $\frac{1}{2}$ " wood squares and bought others. One of the accompanying drawings suggests different ways of making them.

You Learn from Mistakes

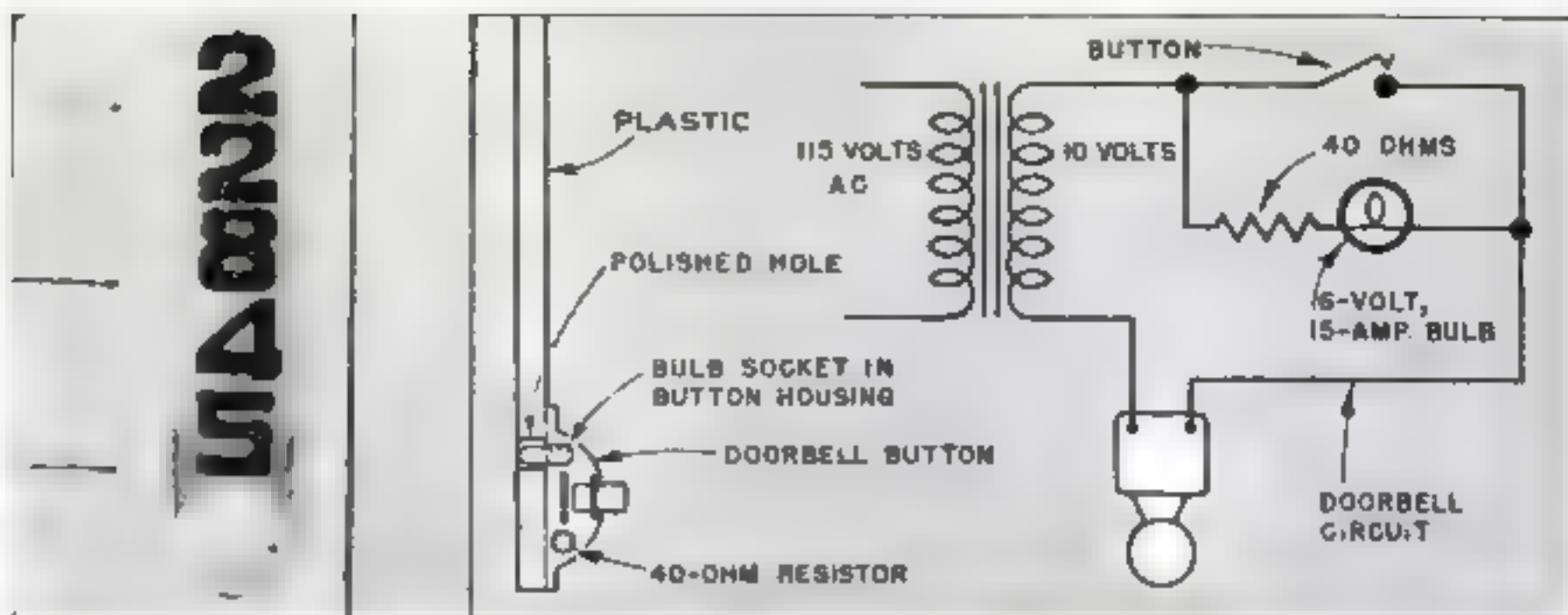
To get started on such projects, the tyro craftsman just needs imagination and a normal amount of perseverance. Don't worry about mistakes. You'll learn from them, no matter what school of design you follow. Even now, when I think I've learned a lot and am getting pretty good, I'll make three drawers that are supposed to be the same size and fit them in. They'll be perfectly satisfactory, but by golly they won't be interchangeable—and this should be possible if they were exactly right.

But does it make any difference? Well, take a look at the photographs of my projects—and decide for yourself. **END**

DRAWERS



* Dimensions are details. After all, you've got a thumb!



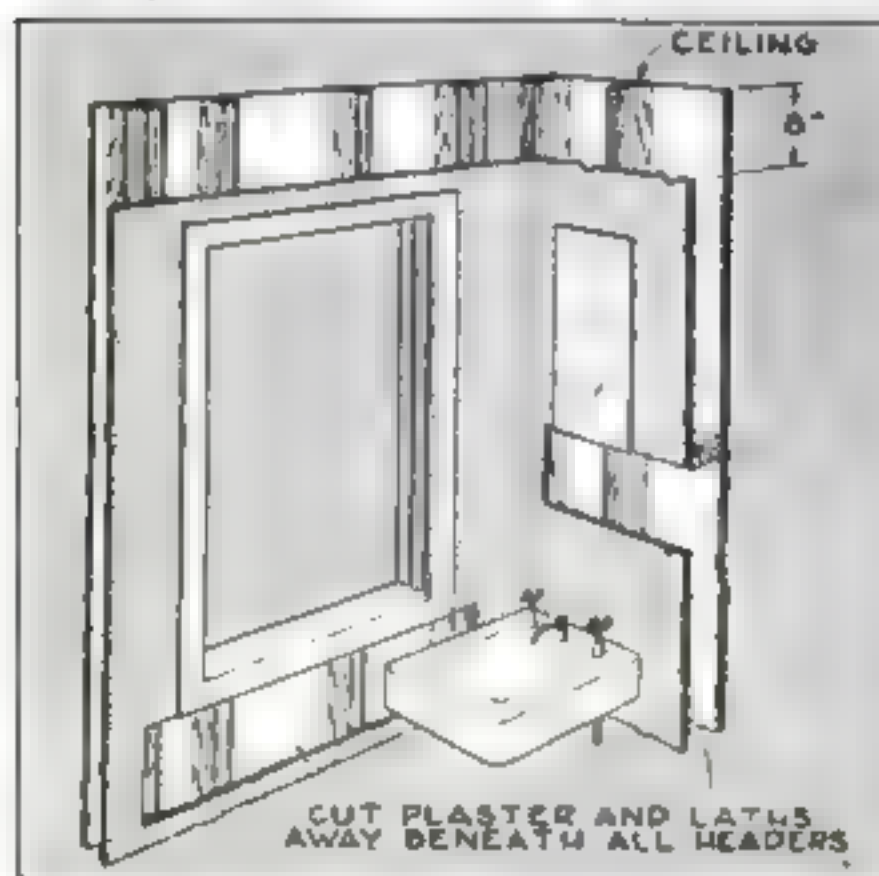
Edge-Lighted Plastic Shows Up House Numbers

ILLUMINATING a small plastic sheet bearing your address will light the way for friends and callers. The one shown is made of $\frac{3}{8}$ " by $2\frac{1}{4}$ " by 14" stock. Numbers were painted on after the surface was sanded, but engraving clear plastic might be better.

A standard doorbell button serves to close

the bell circuit and also to house a 6-volt bulb and 40-ohm resistor. The light is on all the time, but the bell doesn't ring unless the button is pressed because of the low current in the circuit. If it should, or if the transformer heats up, substitute a larger resistor.—PETER P. RUPPE.

Between-Wall Insulation Is Added from Inside



WHEN a particularly cold bathroom needed repainting, I took advantage of the opportunity to improve its insulation. At the ceiling and also 8" below, I cut through the plaster and carefully removed the laths.

In the clear spaces a flaky type of rock wool was poured in small quantities and gently pounded down with a weight suspended from a string. Medicine-cabinet and window headers prevent the insulating material from being pressed in from above, so additional spaces are cut away below these

obstructions. Areas blocked by stacks, pipes, and electrical conduits are filled with a pellet-type rock wool. This need not be pounded, but it will go right through any hole at the floor level unless the hole is stopped by a few handfuls of flakes.

Batting is packed into the parts from which the plaster has been removed, and is held by replacing the laths. Plaster board was found most satisfactory for covering these areas, and the cracks are filled in with patching plaster.—L. G. LIGHTON.

New Device Lines Barn Floors

A ROTATING spreader that distributes bagged lime, superphosphate, or disinfectant chemicals is being made by Coburn Manufacturing Co., Whitewater, Wis. Farm practice and health regulations require frequent spreading of lime in dairy barns, and this device cuts the time and labor needed for the job. The material is spread in a wide, even band as the machine is pushed, wheelbarrow style, across the barn floor.



Lifeboat Converted to Schooner



BOUND out of Aruba during the war, the tanker *Eso Bolivar* was torpedoed in the Windward Passage. All that came ashore on the Haitian coast was one lifeboat, empty.

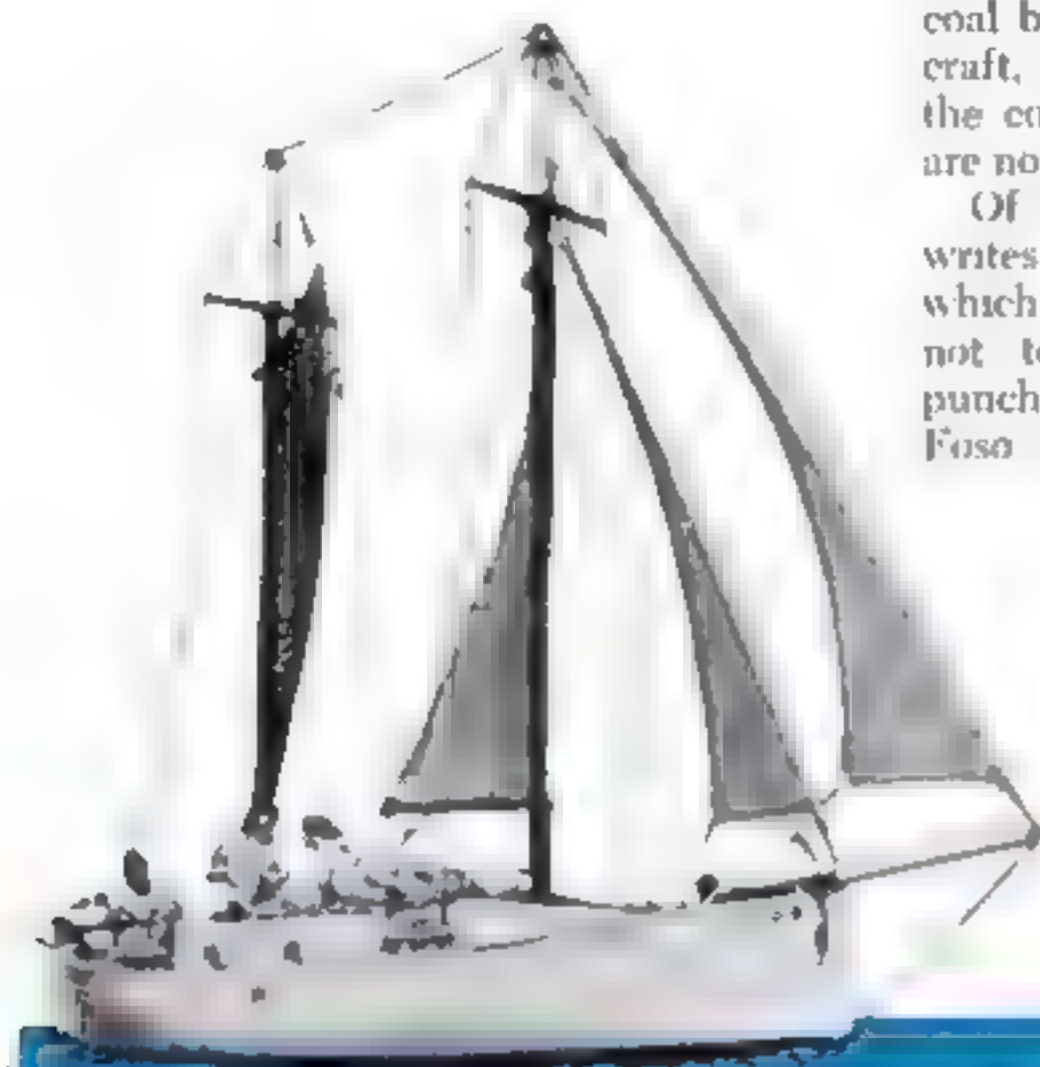
Bidding at a public auction, William A. Krauss bought the boat for \$22.50. With about \$350 for materials (plus some fittings scrounged around Haitian waterfronts), Krauss converted her to the sturdy little schooner yacht shown here. He welded on

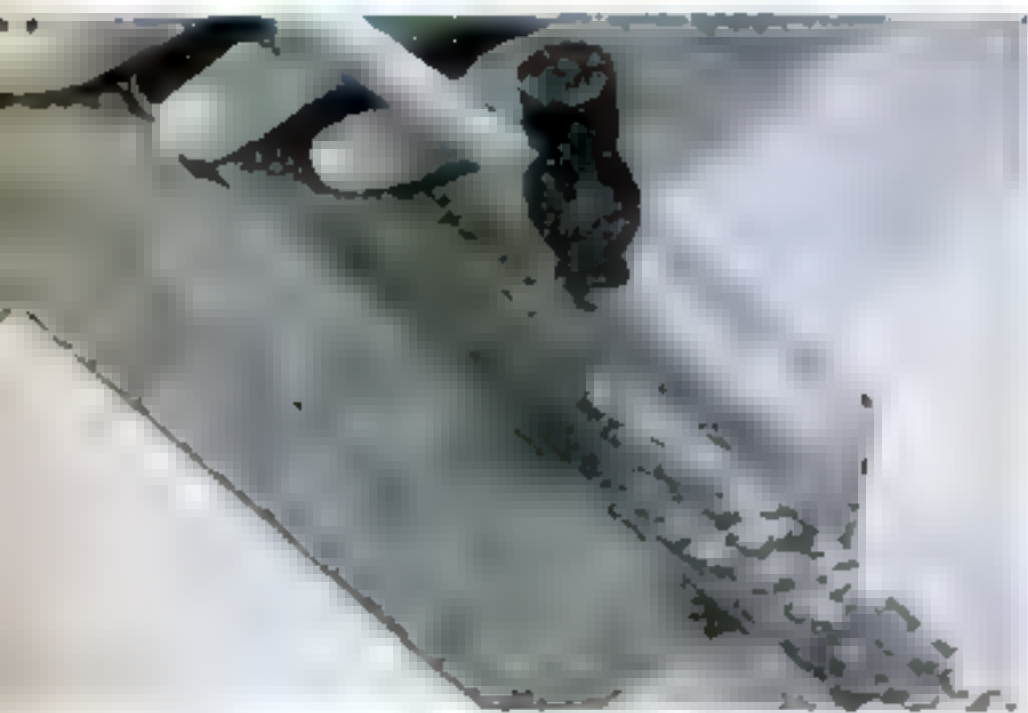
a 2,000-lb. keel, added a 5'6" by 10'6" cabin with decks and cockpit, and installed a bald-headed schooner rig with a sail area of 500 sq. ft. The result was a handy little craft measuring 24' over all, 8' beam, and 3'6" draft.

Underneath the foredeck is a peak locker with space aplenty for stowing sails. In the cabin are two 6'6" berths, lockers, shelves, water tank, and galley sink. Under the afterdeck is space where Krauss keeps his cookstove, which is simply a sandbox and a charcoal brazier, as on many Haitian coastwise craft. At mealtime the rig is brought into the cockpit, where cooking odors and heat are no problem, and afterwards restowed.

Of her performance, her proud owner writes: "She's not fast, but she's brawny, which, in West Indian waters, is a detail not to be ignored. One afternoon she punched us through a 75-knot wind in the Foso Road (we took it on the starboard quarter and ran on the headsails).

Her best time for 10 nautical miles is 1 hour and 19 min.—lively enough for our purposes. The schooner rig, which might meet reasonable opposition in some sailing areas, seems to us exactly right for Haitian waters, permitting the handiest reduction of sail when she meets tropical squalls." JOHN G. KINGDON.





Peen a hammered pattern on the edging strips and the disks and rings of both the jar holders.

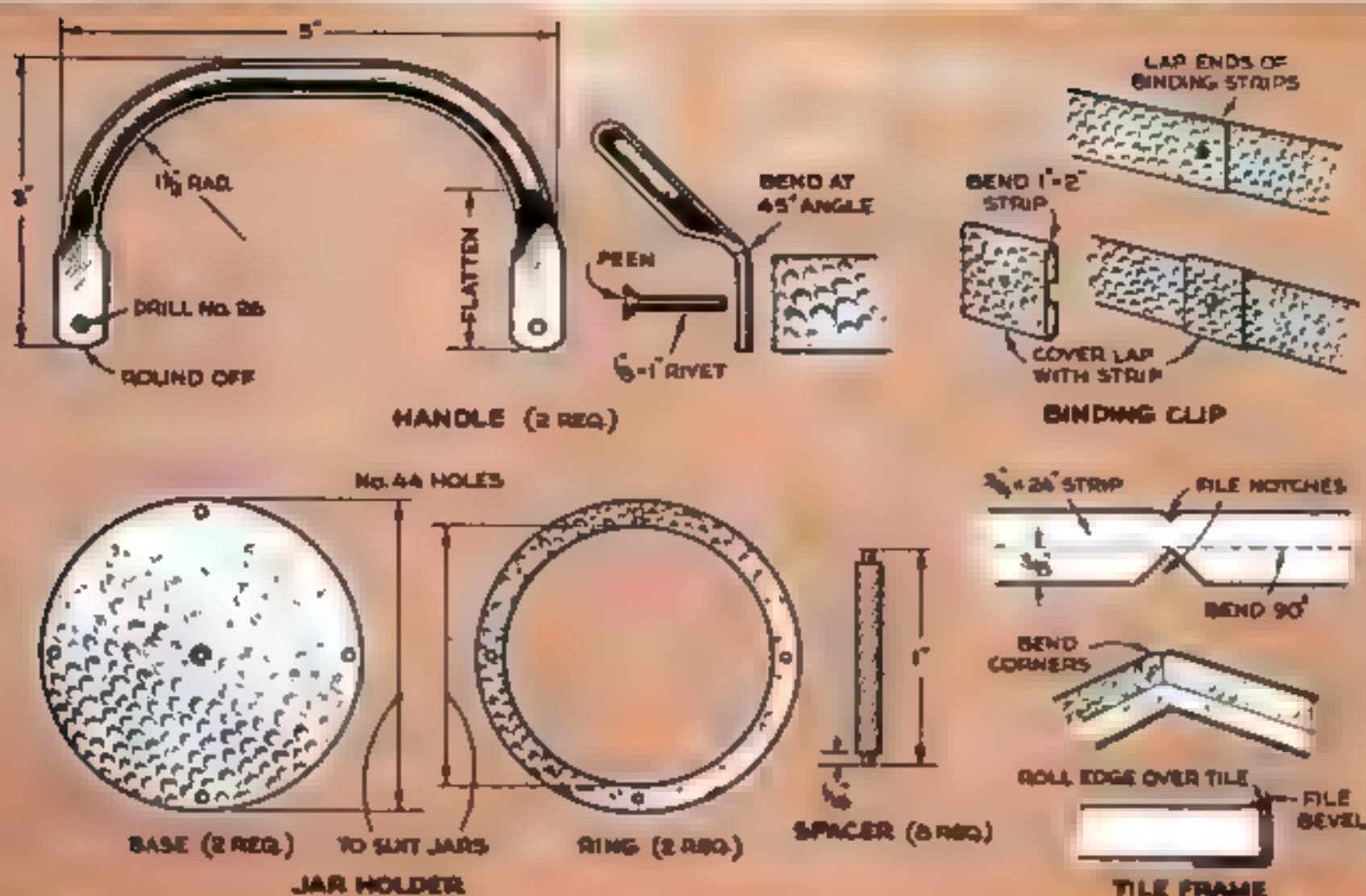
Snack Tray Combines Wood and Copper



Assemble the jar holders by heading over the ends of the spacers. Cut eight spacers 1" long from No. 8 copper wire, turning down the ends.



Fasten the tile holder with small wood screws as in the center. After slipping in the tile, gently roll down the upper edge of the frame.



By Bill Luther

BESIDES adding a bit of color, the tile that's attached to the center of this tray has two practical functions. You may rest the teapot on it—or you may use it as a cutting board. You'll want to buy the tile, as well as the ceramic mustard and mayonnaise jars, before you start construction, and then proportion their holders accordingly.

Begin by cutting a 14" by 20" panel from 3/4" plywood. Then, after sanding the best face, rub on a thin coat of white lacquer, wiping off the excess. When the lacquer has dried, rub it down with very fine abrasive paper and plenty of oil, leaving only enough white to bring out the wood grain.

For the edging, cut two strips of 18- or 20-gauge copper 1" wide and 34" long. Form clips to join the two strips at each end of the tray from 1" by 2" pieces of the same stock. After peening and polishing, hold the binding in position around the tray and lay out pilot holes for 3/8" copper tacks. Then, with the edging still in place, make holes through the copper and into the wood with a No. 50 drill.

The handles are 11" lengths of 3/8" copper tubing. Heat to a dull red color, cool, and shape with the fingers around a 1 1/2" pipe. Flatten the ends, drill No. 26 holes in each, bend all ends to the same angle, file smooth,

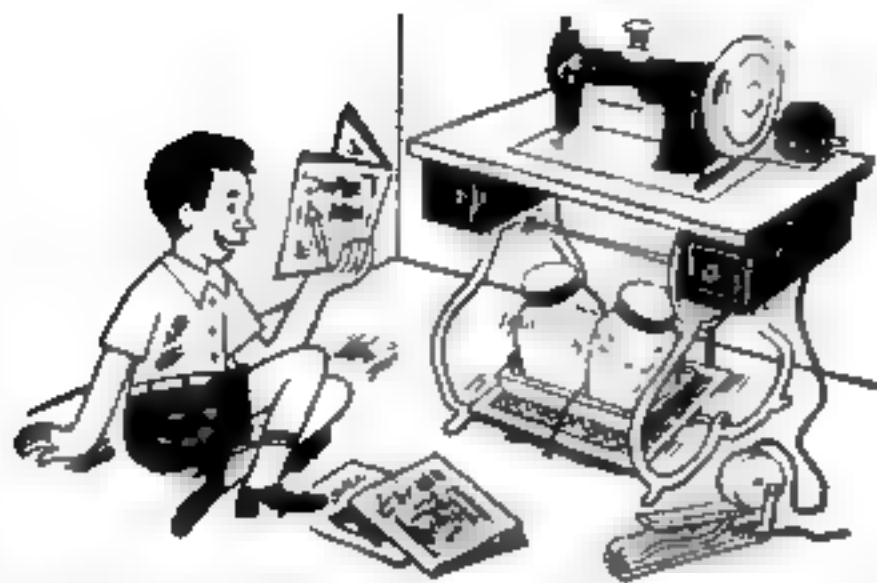
and round off. After polishing with steel wool, center the handles on the tray and drill slightly undersize holes 1" deep into the wood. Holding the handles in place, drive in 3/8" by 1" flathead copper harness rivets, peening down the heads.

From 18- or 20-gauge copper cut two disks and two rings to suit your jars. Space four No. 44 holes around each piece and at the center of the disks drill another, counter-sinking it for a flathead brass screw 1/4" long. For the spacers, saw eight 1" lengths of No. 8 copper wire and file or turn down the ends so they can riveted in the disk and ring holes.

From sheet copper cut a 1/2" strip 24" long or whatever length is required to go around your tile. After filing notches for the corners, bend the strip 90 deg., drill and counter-sink No. 44 holes in the bottom face for small wood screws, and bevel the top edge with a file. Then anneal the copper, form it around the tile, and attach the frame to the tray. Now slip in the tile and, with a small punch, gently tap the edge of the frame over it. Finally, use a round-end rod to roll down the edge.

Mask off the tile and apply a thin coat of lacquer to the entire project. When thoroughly dry, rub down the wood panel only with fine paper and oil. Leave the lacquer on all of the metal parts.

What's Your Ingenuity Quotient?



It gave me a turn to be without a churn when my mother wanted 5 gal. of cream made into butter. Luckily we had an old treadle sewing machine with an electric motor drive attached. I tied two cheese boxes to the treadle, and two 2-qt. fruit jars into the boxes. Leaving the motor in drive position, I put on the belt to the flywheel so the treadle would rock. With a board wedged into the foot motor control, the treadle churned a gallon every eight minutes, with no help from me.—BILLY LOCKART.



I tackled a dent in my car door with a football. It was a simple oil-can dent that would pop out if pushed. Not being small enough to get inside the door to hammer it out, I had to do it the easy way. I deflated a football, attached a tire pump to its stem, and pushed the football down into the door, centering it behind the dent. Pumping up the football snapped the metal back into place. Touchdown!—J. C. SIGHTLER.



Radio Plays Detective. A broken wire was hiding out somewhere in an electric heating pad I had to fix. Knowing it would be tough to locate the break, I looked for something to put the finger on the culprit. I turned on the radio, connected the pad, and flexed it part by part until the radio squawked. Then I knew I had my fingers right on the trouble, and fixing it was easy.—DENNIS WILLIAMSON.



Even ringing twice, the postman couldn't lick the trick acoustics in our house, because in some rooms the door buzzer just couldn't be heard. I solved the problem by mounting the buzzer on a cold-air return duct in the basement, using self-tapping screws. With all the air ducts of the heating system to pipe the sound, the buzz is amplified to an attention-getting level everywhere in the house.—A. L. BREEN.

Have you pulled off a smart one lately? We will pay for acceptable contributions showing ingenious solutions of problems in the home, shop, garage, or camp. It doesn't matter if it's wacky — if it works.

Man-Size Ash Tray

EVEN a chain smoker won't fill up this ash tray in a hurry, for it's a full inch deep. Made of gleaming brass, it can be decorated with a monogram if you like.

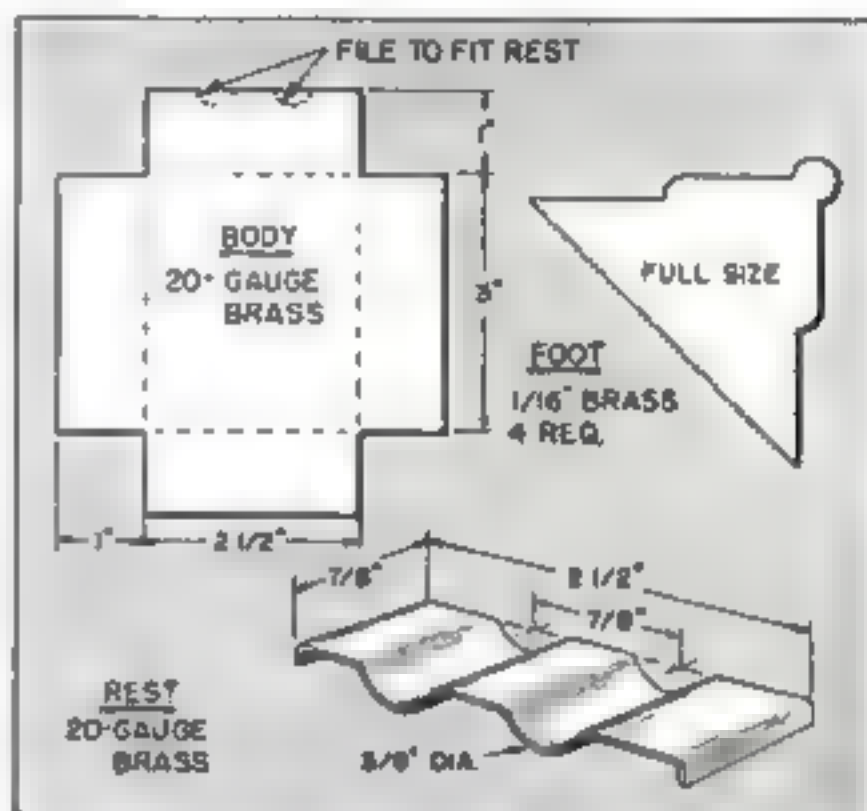
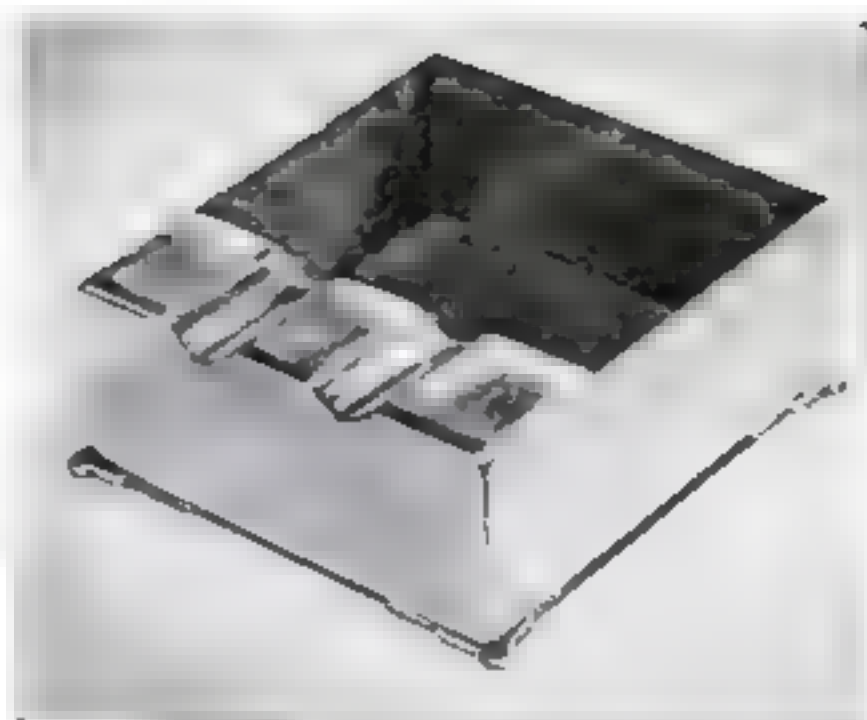
On 20-gauge sheet, lay out the body pattern shown. The lines will show up better if the metal is first scrubbed with kitchen cleaning powder. From a 1" board cut two blocks 2½" by 3". Clamp the body blank between these blocks in a vise, lining them up carefully with the center section shown dotted in the drawing, and bend over the projecting parts with a mallet.

File the corners, if necessary, to fit with no visible gap. Wrap a piece of black-iron wire around to hold it together for soldering. Stand the piece on one corner, and put a little flux and bits of solder inside the joint. Then apply heat until the solder runs freely along it. If you've been sparing of solder, little will have flowed out. Clean off any excess with files and abrasive cloth.

Feet can be cut from 1/16" sheet with a jeweler's saw, or you can cut a simple triangle and file it to shape. Tin the feet and the tray corners; then sweat the feet in place. Polish the undersides so that the feet won't mark table surfaces.

Cut a ¾" by 3¾" strip of 20-gauge sheet for the cigarette rest. Lay it on a grooved block and form it by hammering on a ¾" dowel or rod laid over the grooves. Bend down both ends, tin them and the contacting tray surfaces, and sweat the rest in place. Then file notches in the body flush with the grooves in the rest.

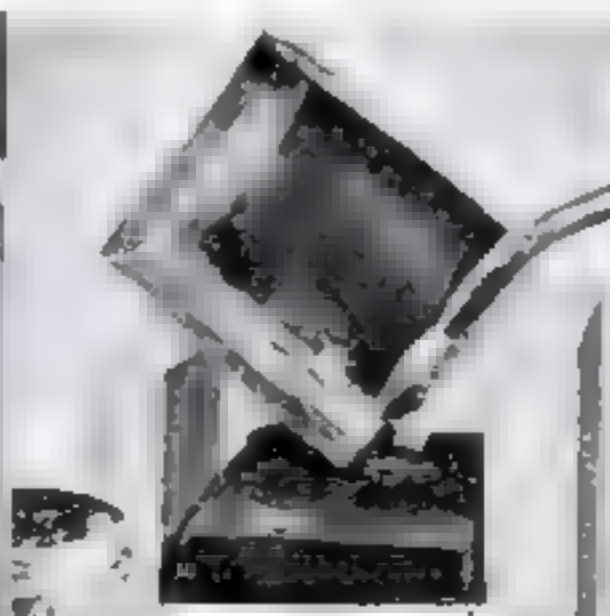
Steel wool will create a satin finish, or you can get a high luster with tripoli and jeweler's rouge. Wax the metal to prevent dulling of the finish.—BILL LUTHER.



Lay out the pattern on 20-gauge sheet, using square and rule. Cut along outside lines only.

Shape the blank by clamping it between two wooden blocks and hammering down the sides. Bend the four corners and run solder into the

joints by applying heat (center). Hammer the grooves in the cigarette rest with a rod or dowel, using a wooden block with notches as an anvil.





Makes Coffee for One. With this device you can make coffee a cup at a time. Placed over the cup, it operates on the drip principle, hot water seeping through the coffee and a cloth filter. Priced at about \$1, it is made by Hartford Products Corp., Chicago.



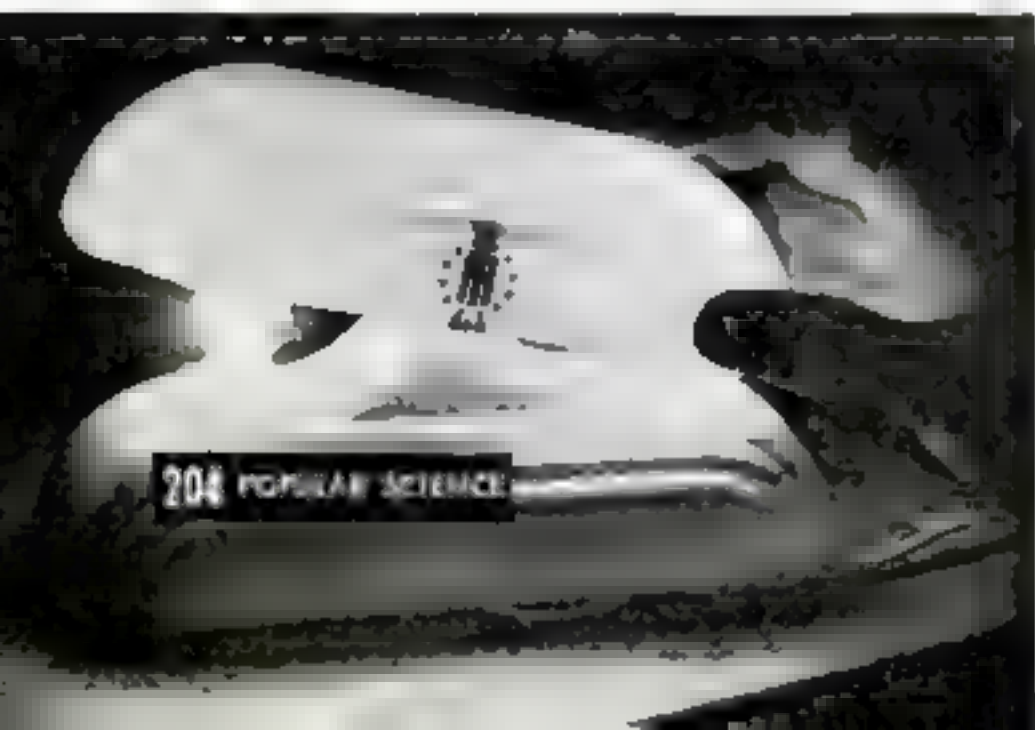
It Washes and Rinses. A dish-washer made by L. K. Franklin Corp., Los Angeles, consists of a brush on a hose that attaches to the faucet. For washing, water mixes with a detergent in the head. For rinsing, a button turns on clear water.



Shade Turns on Light. The shade of a night lamp offered by Hungerford Plastics Corp., Murray Hill, N. J., also serves as the switch button. If you tilt the shade in one direction, one of two seven-watt bulbs goes on. Tilt it the other way, and the second goes on. Tilt it again, and the light goes off. The lamp sells for about \$3.

Heater Is Pocket Size. Whether you're at home or deep in the wilds on a camping trip the little gadget at the left offers a means of quickly heating liquids or canned foods without a fire. A product of wartime research, it's called the "Heatron stirrer" and is produced by the Catalyst Research Corp., Baltimore, Md. When the plastic handle is pulled back and released, an internal spring sets off a chemical charge, generating intense heat without fumes. The charge fits into a copper housing.

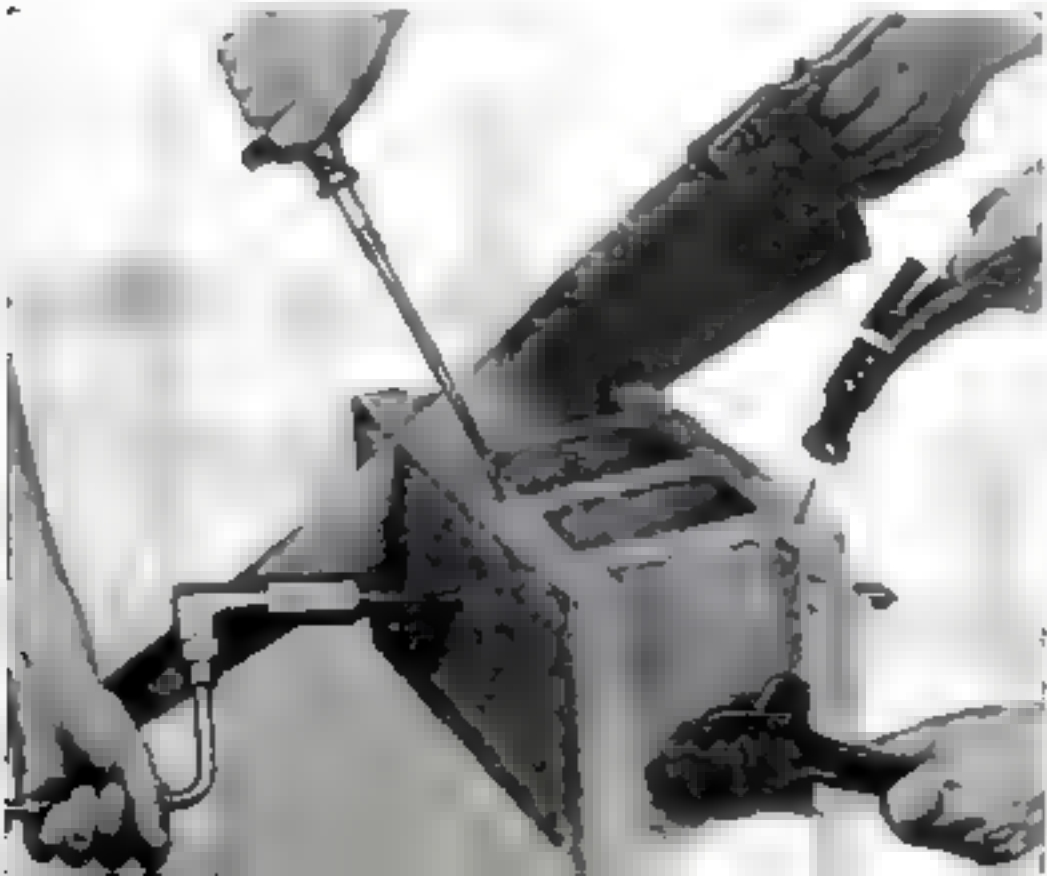
Hose Connector Swivels. The faucet hose connector pictured below contains an elbow that can be rotated through a full circle. Hence, the hose is less likely to be damaged by being bent near the faucet end. In addition, the straight pull extends the radius of the hose. The Kiener Machine Products Co., Los Angeles, makes it.





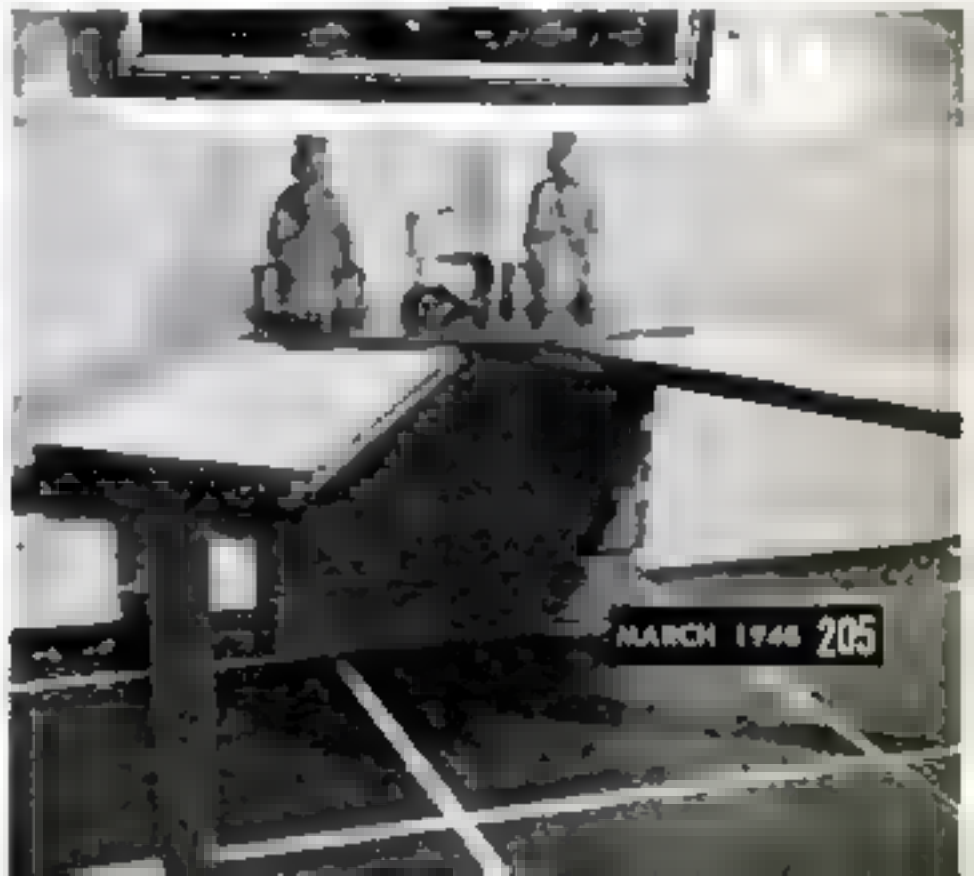
Pen Carried on Key Ring. Little larger than an ordinary matchstick, this ball-point pen was designed for carrying on a key ring; in fact, the ring is supplied with the pen. Made of metal, the pen has an outer sleeve that slips down over the point to keep ink from soiling your pocket. A product of the Carter Company, Elizabeth, N. J., the pen is not refillable, but the ink charge is said to give about a year of ordinary use. The pen sells for about 50 cents.

New Blocks Made of Fiber. The busy scene below illustrates the ways you can work a new type of building block. Consisting largely of wood fiber bonded with special mastics, the block looks like a conventional concrete block, but it weighs only half as much. Tests have shown that the blocks are resistant to fire and have good insulating power. Made in the same sizes as cement blocks, they are distributed by Marketing Associates, Saginaw, Mich.



It Sharpens as It Rolls. With this knife sharpener, you insert the blade between the grinder and one of the two plastic wheels. This automatically adjusts the knife edge to the correct angle. Then you roll the sharpener back and forth on a table with a simple pull-push motion of the knife. Ten times forward and back on each side is said to give a keen edge. It's made by Alden Speare's Sons Co., Cambridge, Mass. The stone is fine-grain aluminum oxide.

Table Swings Against Wall. As one unit of a new line of furniture adapted to the limited space of an apartment or small home, Paul Bry, a New York designer, has introduced this fold-away table. Normally, the two halves of the top are kept back against the wall, but when mealtime comes they can be swung together, providing a table 36" wide. Silverware and other items may be stored in the drawers below the center section of the table.



lengths of $1\frac{1}{2}$ " angle iron are flush-riveted through the lower jaws and posts as a base.

Drilled to a depth of $11/16$ " at the center to receive the end of the vise screw, the $\frac{3}{4}$ " by $1\frac{1}{2}$ " by $2\frac{1}{2}$ " movable jaw should be a snug sliding fit between the side posts. Two $\frac{3}{4}$ " by $\frac{3}{4}$ " by 4" guide plates are riveted to the sides of this jaw, and a hole is drilled and tapped on each side for retaining screws. The ends of these should fit loosely into a groove turned in the end of the vise screw, holding it in place but allowing it to revolve freely.

For the screw, turn down a $\frac{3}{4}$ " rod to $\frac{1}{2}$ " except for a head $1\frac{1}{2}$ " long. Turn the other end even smaller to suit the hole drilled in

the movable jaw. Thread the screw $\frac{1}{2}$ "-11 or similarly, cutting the threads on the lathe if possible. However, die-cut threads will be satisfactory if care is used to start the die accurately. To do this, hold the work in the chuck, place the die squarely against a drill pad, and then feed both the die and drill pad against the work with the tailstock hand wheel while turning the spindle by hand.

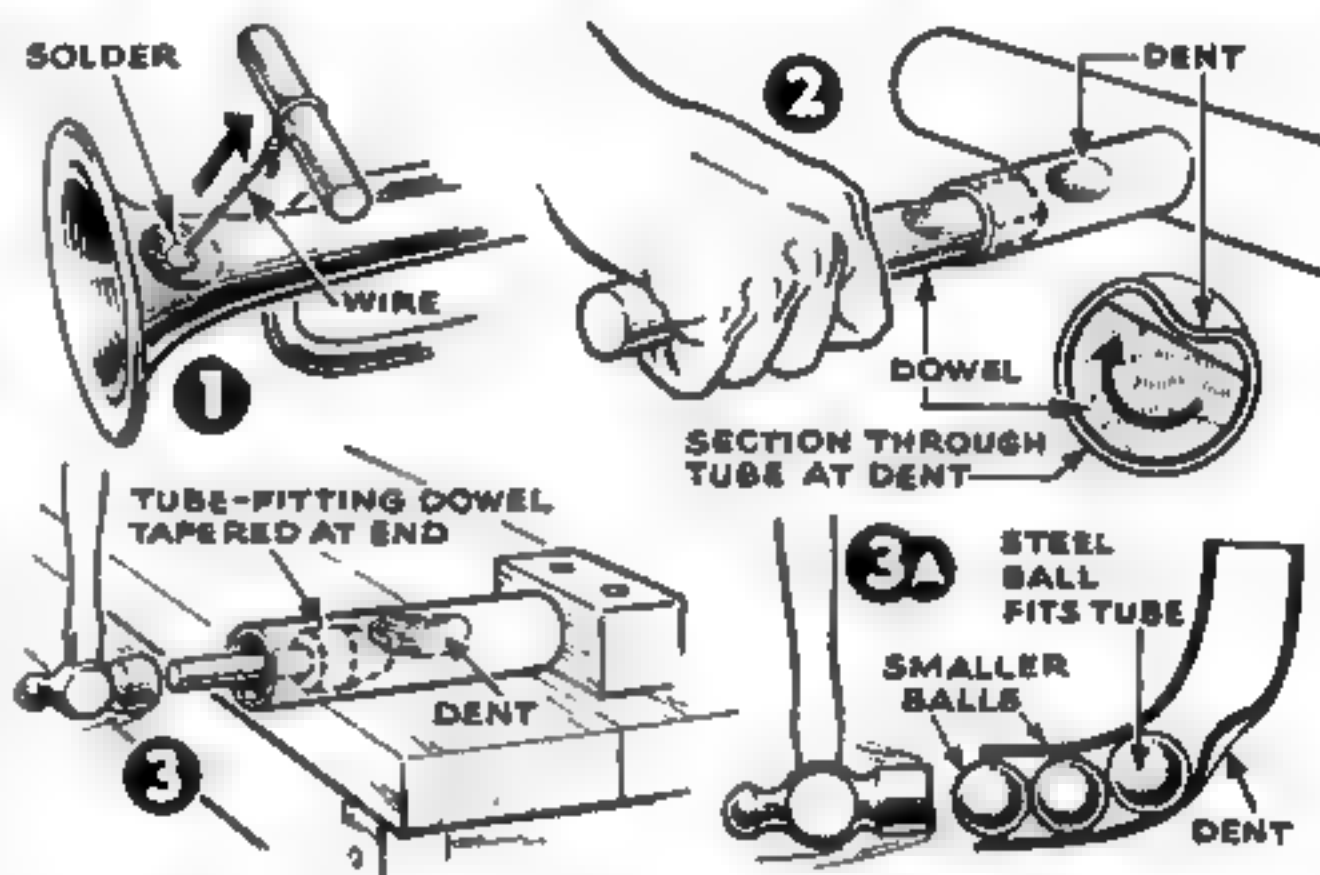
Cross-drill the head for a drive-fit $\frac{1}{2}$ " by 6" hand bar. When this has been centered, drill the head and bar for a $\frac{3}{4}$ " pin. Driven in, this pin keeps the bar permanently in place. Turn down the vise screw into the movable jaw, adjust the retaining setscrews, and the job is finished.—C. W. WOODSON.

Tube Dents May Be Removed by One of These Ways

WHEN thin metal tubing has become dented, it usually can be straightened by one of the methods illustrated here.

If a dent occurs in a brass musical instrument where it cannot be pressed out, solder a small loop of wire to the lowest part, tie string to the wire, tie the other end to a piece of wood as in Fig. 1, and bring the metal back to place with a few careful jerks. Then remove the soldered wire and clean and polish the metal.

For straight tubing, you can turn a hardwood dowel to the exact bore of the tube, make a flat on one side, insert until the flat comes under the dent as in Fig. 2, and turn slowly to force the metal back into shape. A tapered dowel (Fig. 3) also will do the job.

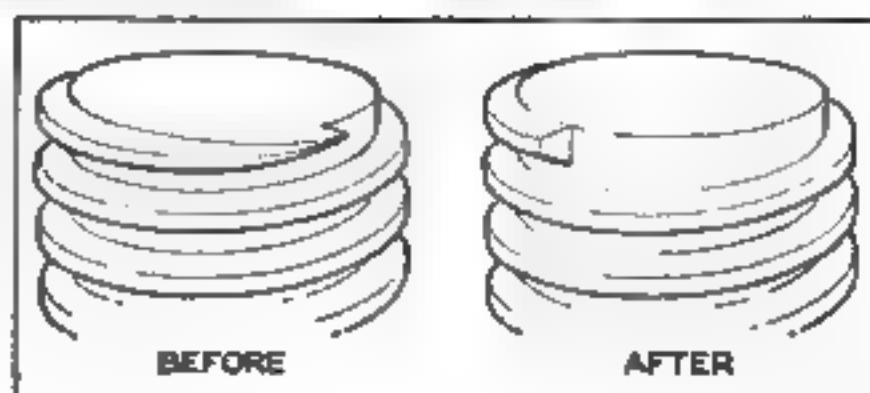


If the tubing is open at both ends, you can also use a steel ball exactly the size of the bore, inserting two or three balls of smaller diameter behind it to drive the full-sized one past the dent. The leading ball will then press out the metal.

For bent tubing use the ball method as seen in Fig. 3A.—HERBERT E. POTT.

Grinding Off Thread Improves Action of Chuck

ALTHOUGH I have always tried to keep the internal threads of my four-jaw chuck clean, the screws nevertheless become clogged by chips after a while and difficult to turn. I have found that this can be prevented by grinding off the incomplete part of the thread. The squared end then has a sweeping action.—MARCEL DUHAMEL.





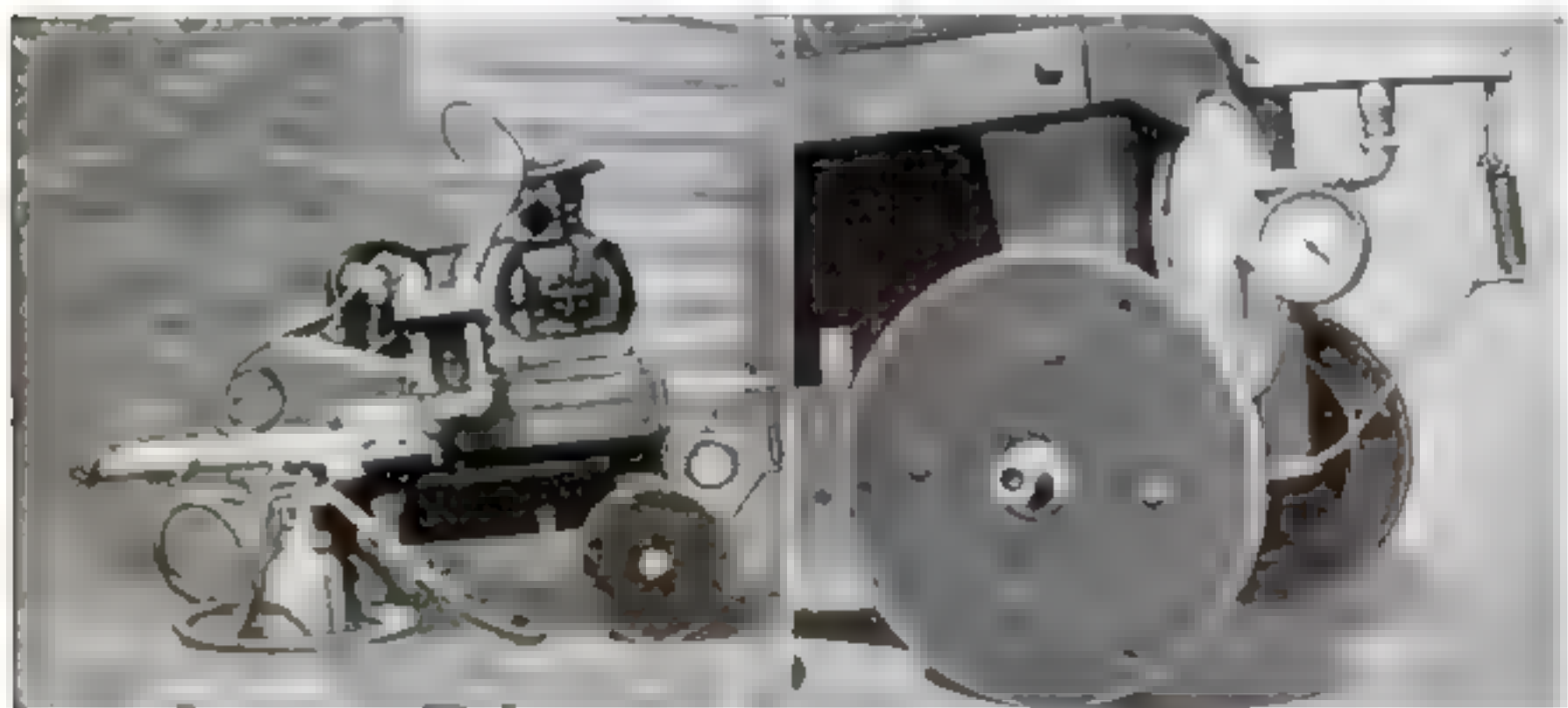
NEW SHOP IDEAS



Bottoming Drill. Flat-bottom holes can be produced with a bit you can quickly make in any size needed. Select drill rod of the required diameter, or turn it to size. Mill or file one end to exactly half its diameter for a length of $\frac{3}{4}$ " to $1\frac{1}{4}$ ". This flattened portion is critical; if it's more or less than half diameter the edge cannot cut freely. Form a 15-deg. bevel on the end as at right above. Heat the tool red hot and quench in motor oil. Polish off the scale and reheat to

a medium straw color. Quench immediately in the same oil. If the color turns to blue, the tool will have to be rehardened. Touch up the edge with a fine stone after hardening and tempering.

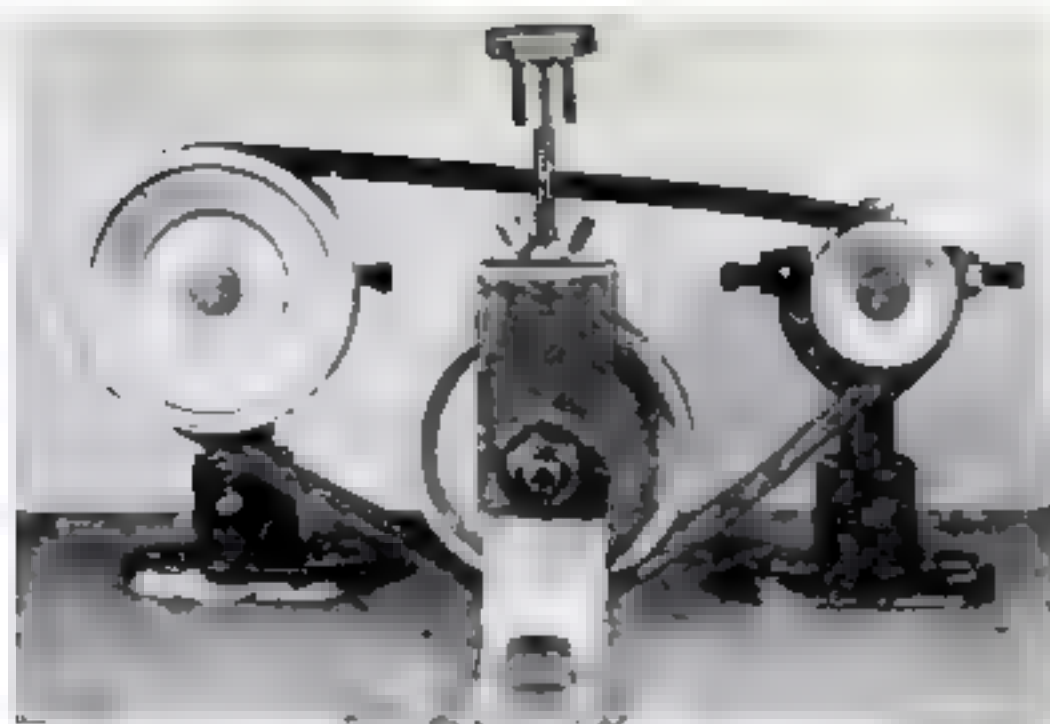
Since the action is that of a single cutting edge, the tool should be used in a lathe or drill press run at slow speed, the work must be securely held, and the hole should first be drilled to within $1/64$ " of finished size with a regular drill.—W. E. DANNEMAN.



Compressor Cost \$10. By using salvaged parts, Francis S. Root, of Northampton, Mass., assembled a portable air compressor that can be taken to the garage to pump up tires or into the yard to paint a fence. The compressor proper came from an old refrigerator. A $\frac{1}{2}$ -hp. electric motor was taken from a washing machine, and a tank from a 5-gal. sprayer. To keep oil out of the air, 1" pipe and elbows were assembled into a U-shaped filter unit and filled with steel wool.

An inexpensive pressure gauge was installed, together with a homemade relief valve to maintain the desired pressure. The valve consists of a hinged lever carrying a rubber plug which rests against the open end of an elbow connected to the tank. Relief pressure is set by tensioning a spring fastened to the lever with a bolt and nut.

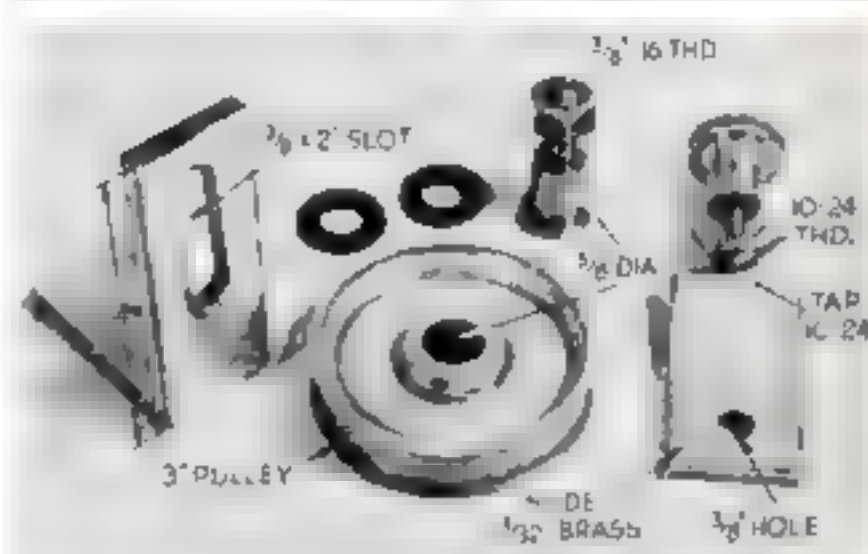
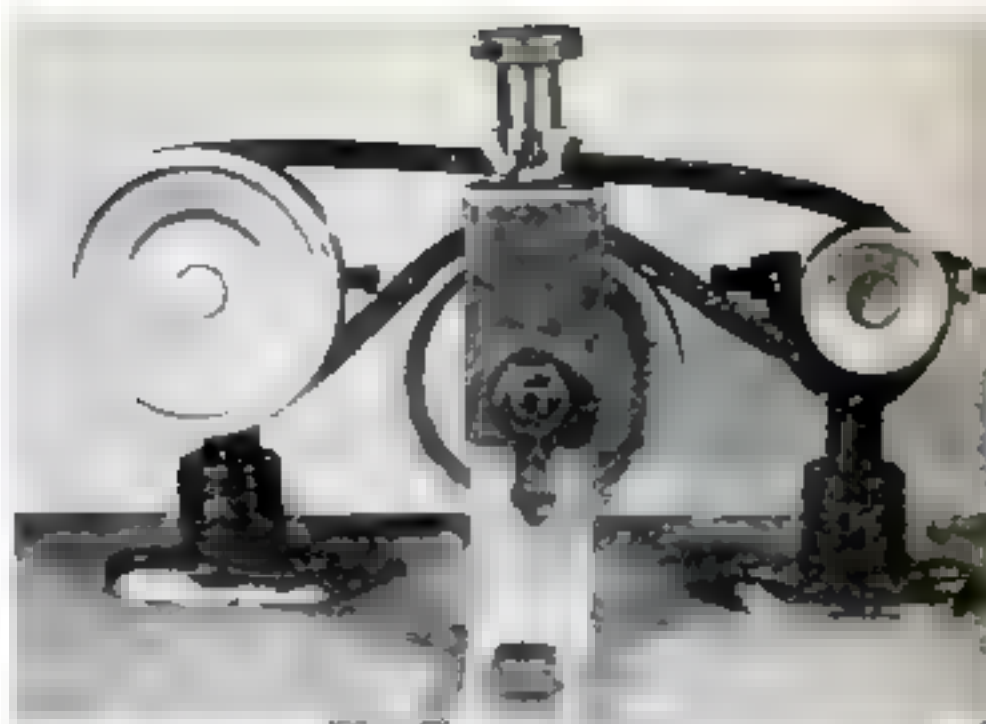
The compressor is driven by an auto fan belt, and connected to the tank by copper tubing. Everything is mounted on a wooden frame supported on two wheels at one end.



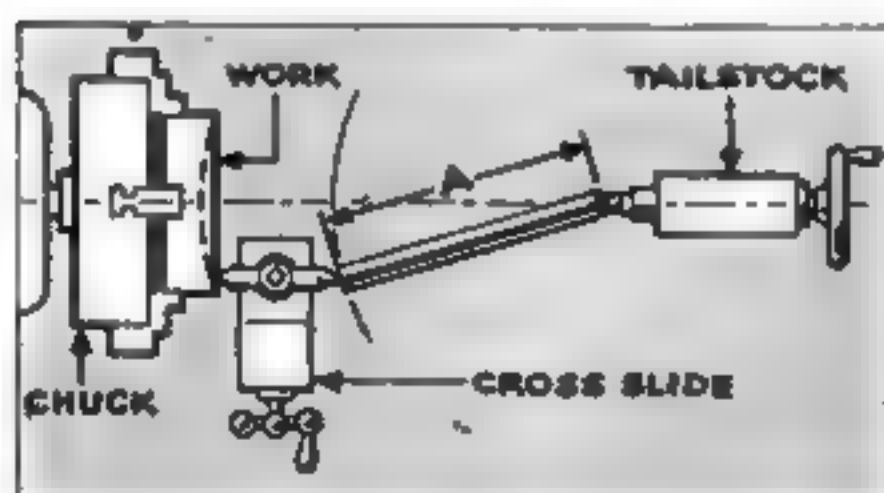
Idler Tightens Belts. V-belts stretch and then slip on their pulleys. If you have this problem, the adjustable idler above may prove the solution. It runs almost silently, provides a wide take-up range, and runs outside or inside the belt.

The base is a piece of $\frac{1}{2}$ " by $1\frac{1}{2}$ " angle with a slot drilled and filed out. The slide is a boxlike piece bent to shape over the angle to a free sliding fit, and tapped at the top for the adjustment screw. Any standard pulley of reasonable size can be used. The one shown has a flat face with flanges $\frac{1}{2}$ " high, for running outside the V-belt.

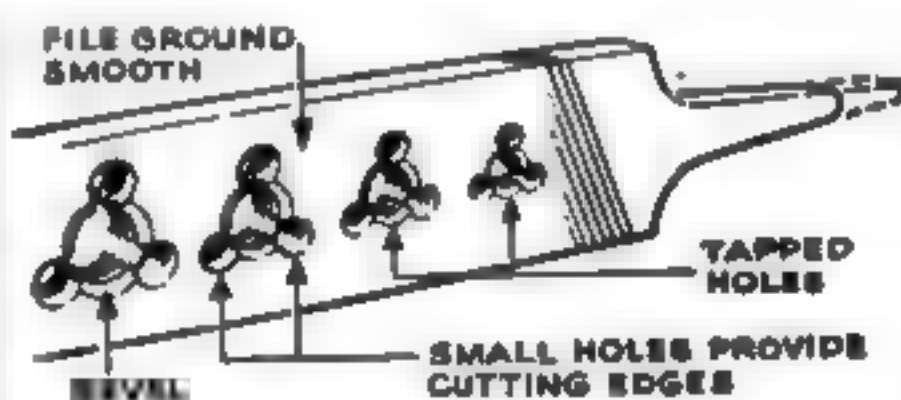
A stud was turned to fit the hole in the pulley, shouldered, and threaded for the clamp nut. You could use instead a finished machine bolt and a nut on each side of the slot to clamp it.



Make the tensioning screw from a 10-24 bolt about 2" long, threading on a wing nut. A knurled head might be added but isn't necessary. Mount the base alongside the V-belt, adjust tension by the 10-24 screw, and clamp by tightening the nut on the stud.—JACK MELLINGER.



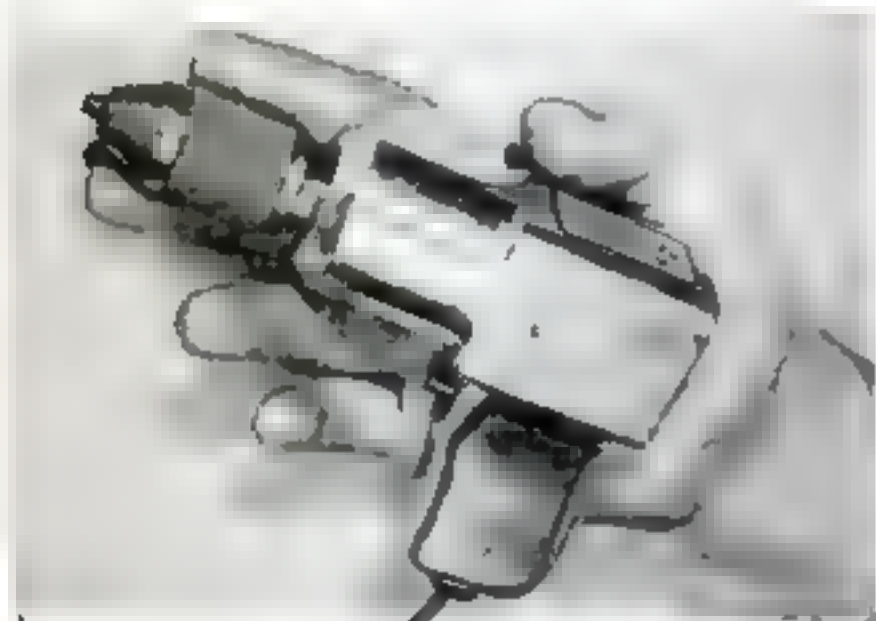
Turning Concave Radius. To turn a true face radius, cut a piece of drill rod the length of the desired radius A . Lightly centerdrill both ends. Set a double-ended tool bit parallel to the ways with both ends at center height, and put the rod between it and the dead center. Advance the bit into the work with the tailstock. Then, holding the carriage back against the rod with the handwheel, traverse the tool with hand or power cross feed.—F. W. BISKER.



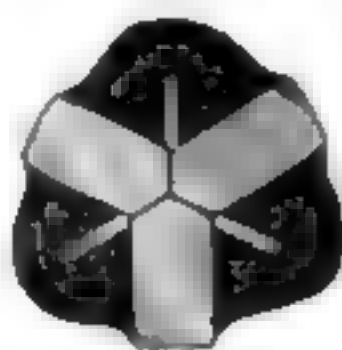
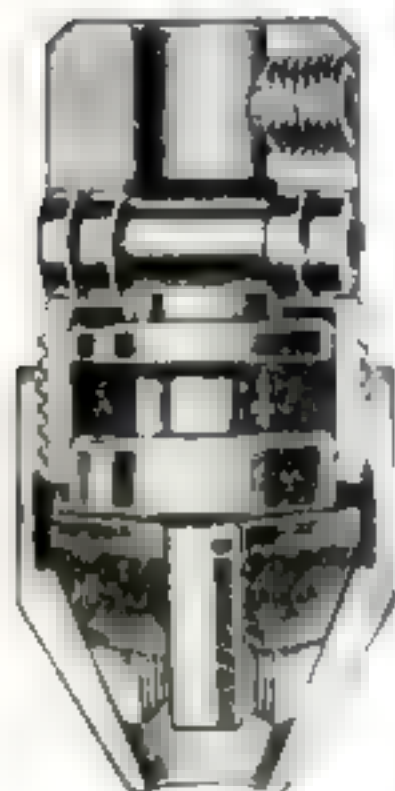
Old File Is Screw Plate. Taking little space in your toolbox, a screw plate made of an old file is handy when a number of different threads are required. Anneal the file by heating it cherry red and burying it in ashes, and grind off the teeth. Drill and tap to suit, using tap drills one size smaller than usual. Then drill three intersecting holes around each tapped one, first punching them carefully so they won't "fall in." Countersink the main holes slightly, reharden the file, and draw it to a light straw color.—H. E. POTT.



NEW TOOLS



Midget Drill. A hand-sized electric drill produced by the Wolfson and Fairclough Mfg. Co., Buffalo, can do the work of larger drills but is particularly handy for craftsmen and hobbyists who work in small scale. The unit, priced at about \$7, operates on 115-volt, 60-cycle AC at approximately 600 r.p.m. It has a pistol grip, a trigger switch, and a $\frac{1}{8}$ " chuck.



Chuck Uses Rubber Insert. In place of the usual spring-held jaws, this new line of chucks from The Jacobs Manufacturing Company, Hartford, Conn., utilizes a single molded rubber triangle to which the jaws are permanently bonded. In one model the chuck is hand tightened on the drill or other tool; in another (illustrated at the upper left) it is first hand tightened, then made machine fast by means of a hex key that turns the cam above the follower.



Saw Has Adjustable Angle. A 49-cent hacksaw with variable blade angle permits the workman to do internal cutting in spaces too small for the usual saw. Handle and blade move up or down inside a channel, and the cutting depth is variable up to 3". A knurled nut locks the blade in the desired position. It's made by Wilson Hardware Mfg. Co., Chicago.

Gun-Grip Iron.

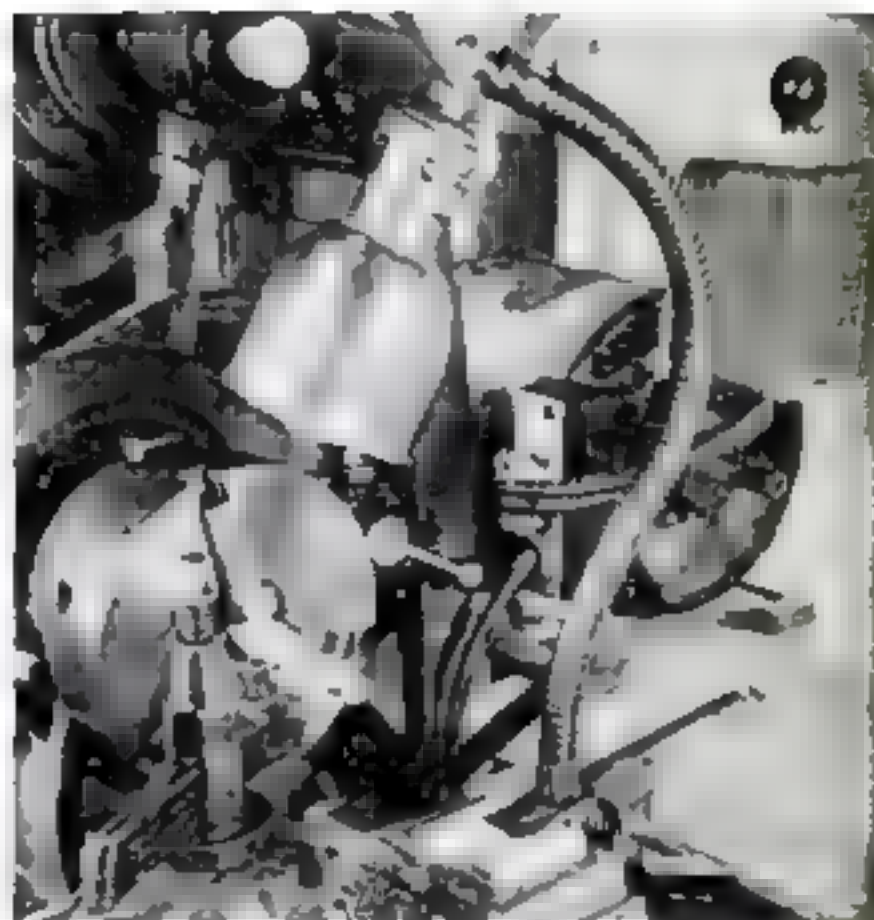
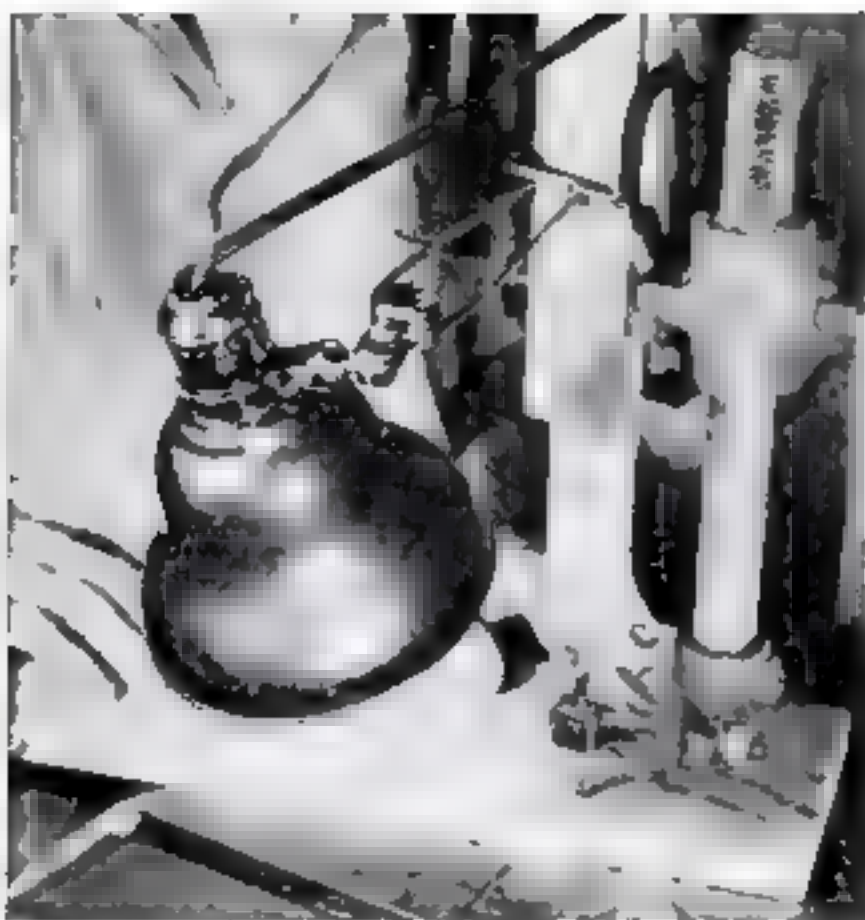
A soldering iron with a pistol grip is easier to hold and use on certain types of work. An offset tip of the kind illustrated allows the solderer to work from directly above on joints that would be hard to reach with a standard iron. The



handle is molded plastic with low heat conductivity. Lenk Manufacturing Co., Newton Lower Falls, Mass., makes the 75-watt iron and four interchangeable tips.



Calker Snaps on Cartridge. A spouted calking cartridge may be slipped into this injector without disassembling the gun. Then the compound is forced out by a pressure plate ratcheted forward by a trigger. The Gibson-Homans Company, Cleveland, designed this low-priced (\$1.98) gun chiefly for minor household repairs such as sealing cracks or replacing putty.



Clamp-on Lamps Put Light at the Point of Work

GENERAL shop illumination, even when at a fairly high brightness level, is often not good enough at the point of work. I find that portable clip-on lights that can pour on brightness exactly where you need it are an aid to better workmanship, reduce work spoilage, and help prevent accidents. Two

kinds are especially good: a spring-jaw type with a double ball-and-socket adjustment, and a clip and gooseneck type with a single ball-and-socket. The former is best used in close, with a 25-watt bulb; the latter lights a bigger area and takes a 60-watt bulb.—JOHN P. ARNOLD,



Close Chucking Saves Drills

FREQUENT breakage of very fine drills can be reduced if they are chucked short, as shown above. If the chuck itself won't permit this, run a $\frac{1}{8}$ " drill up into the chuck body, thus getting clearance for drill shanks. Very high spindle speeds and good cutting oil also help cut down excessive breakage of these small drills.—C. W. WOODSON.



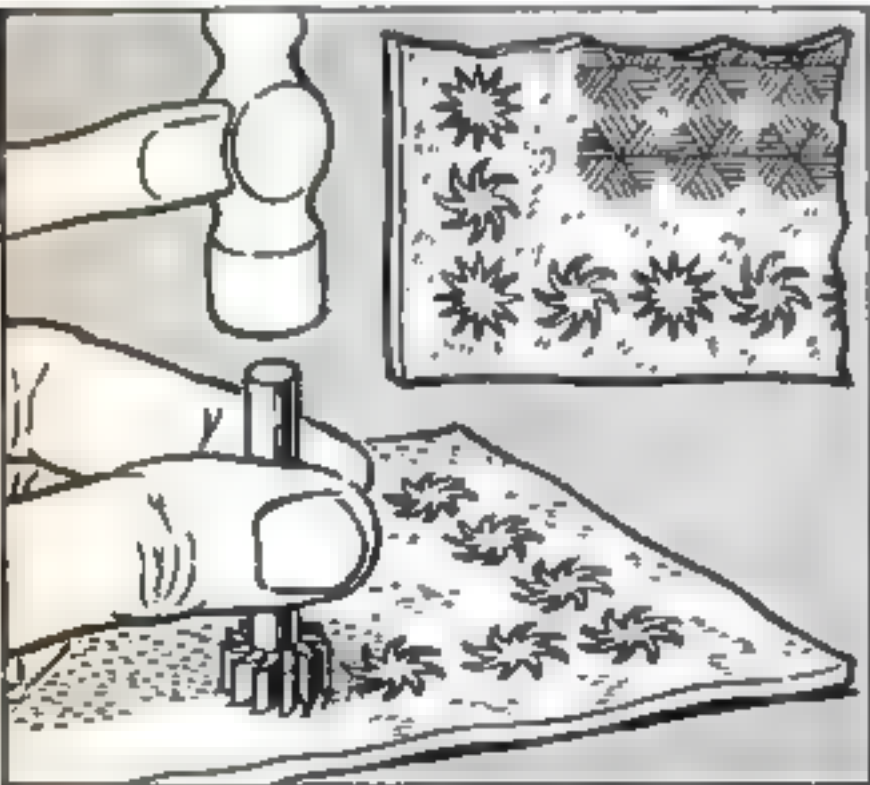
Pad in End Improves Pin Vise

SMALL pin vises of the sort shown can be made easier to use, and breakage of tiny drills can be lessened, if you turn yourself little brass finger pads designed to fit freely in the pin-vise handle. As with a jeweler's screwdriver, the vise is held against the work with one finger while it is twirled.—H. R. PFISTER.



Boat-Trailer Wheels Retract

DESIGNED to fit most inboard and outboard hulls, the rig shown above makes it easy to transport your boat behind a car. At the waterside, the wheels can be retracted inside the hull along the gunwales, hung outside on the oarlocks, or removed entirely and left ashore. Including a car bumper attachment, the outfit weighs less than 50 lb. It is produced by the Saha Manufacturing Company, of Darby, Pa.



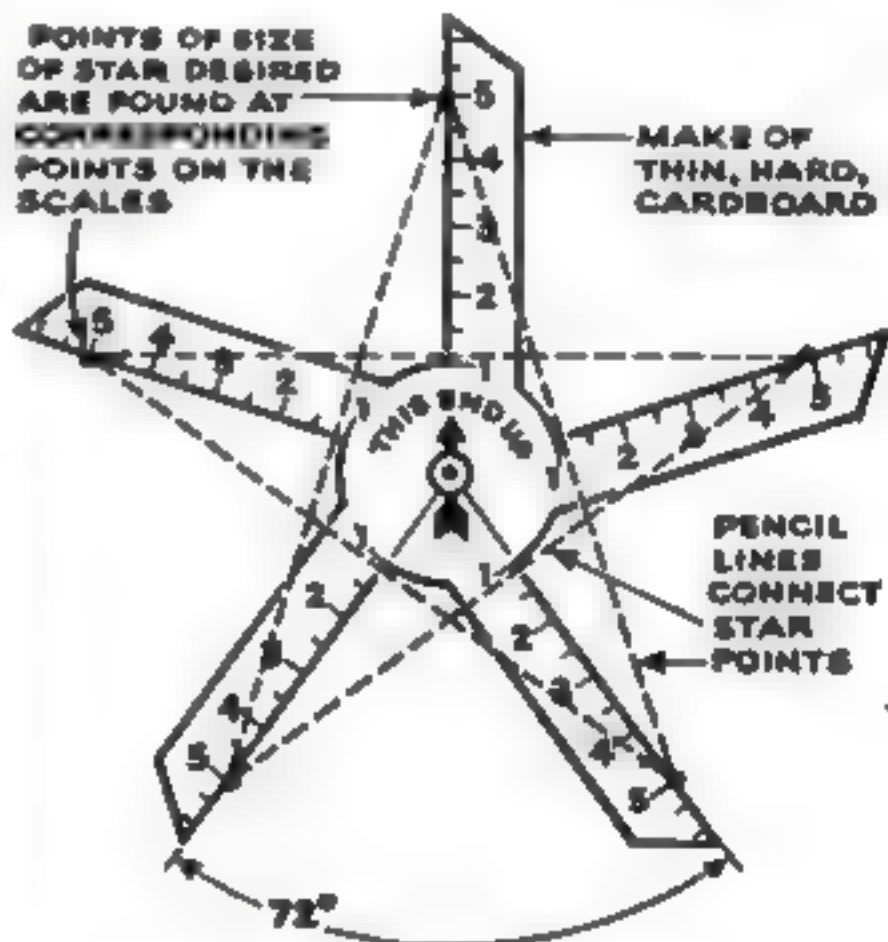
Rotary Files Decorate Leather

ROTARY files are ideal for punching decorative designs on leather projects. Simply place them on the leather at the desired point and strike the shank a good blow with a hammer. In finishing up a leather knife sheath, I used files of three different types and found the effect they produced to be very attractive.—GUTHRIE B. STONE.



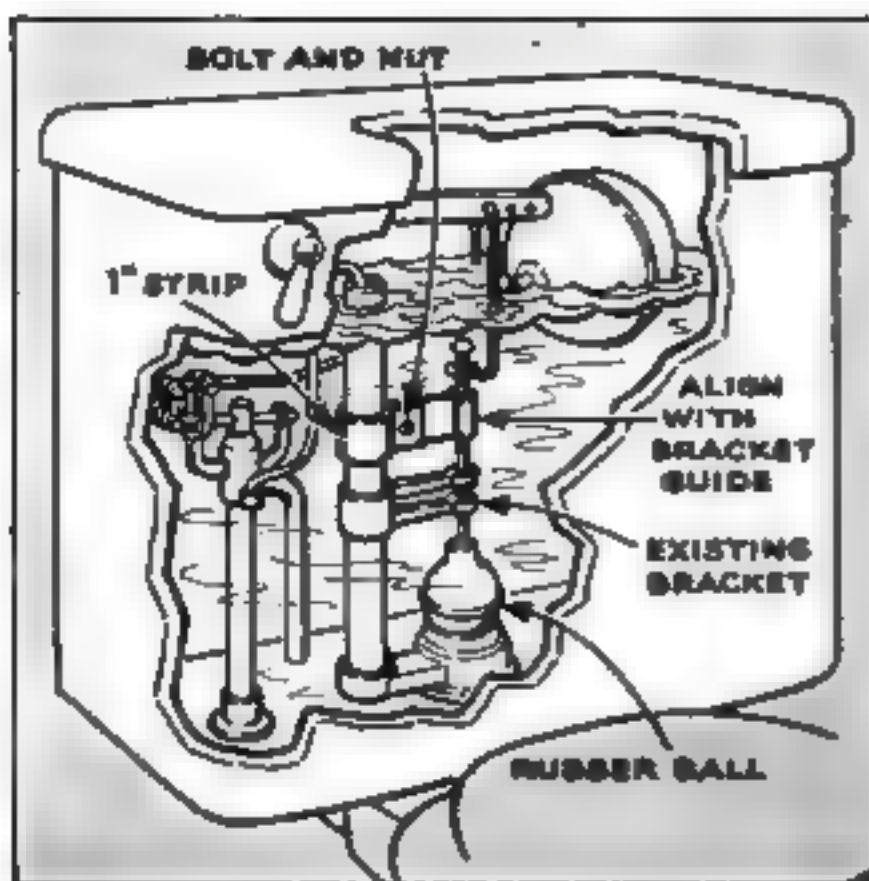
Tractor Blade Does Many Jobs

BUILT to turn a full 360 deg. on roller bearings, this tractor blade was designed for all phases of terracing, grading, scraping, bulldozing, and ditching. Intended for one-man operation, it may easily be raised, lowered, or set at any desired angle from the tractor seat, and an adjustable top linkage regulates the bite. The Danuser Machine Company, of Fulton, Mo., produces it for leading makes of tractors.



Guide Makes Five-Pointed Star

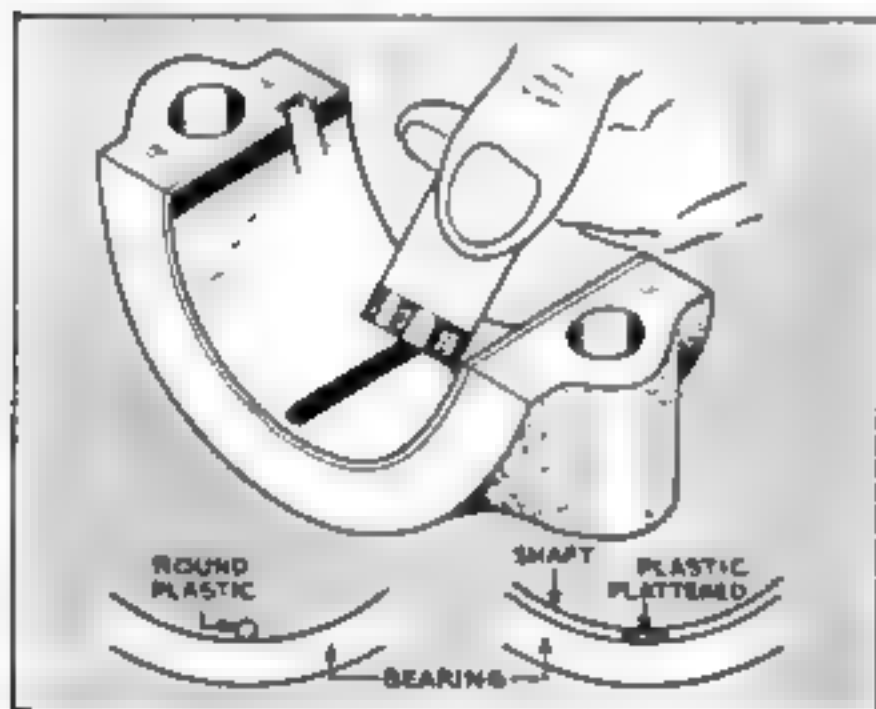
CONFRONTED by the task of making some five-pointed stars, I laid out a guide like the one above on a sheet of cardboard and then cut it out. By using this, a star of any size can be produced by making a mark at corresponding points on each scale and connecting the points with straight lines. In laying out the guide, place corresponding edges of each arm exactly 72 deg. apart as shown above.—G. W. MORTON.



New Bracket Seats Ball Valve

IT BECAME necessary to wiggle the flush handle of a toilet before the ball valve would seat and stop the water, as the ball rod stuck at an angle in the guide.

With 1" strip aluminum, I formed a loop just large enough for the ball rod to slide through and bent the other end around the upright overflow pipe, clamping with a bolt and nut. The ball now drops straight into the outlet.—ERIC RITTER.



Clearance Measured from Flat

ENGINE bearing clearance may be quickly checked with a new method offered by the Perfect Circle Corp., Hagerstown, Ind. It consists of placing a length of round plastic on the bearing shell and tightening the bearing cap. The cap is then removed and the width of the flattened plastic is measured with a scale on the envelope in which the plastic is packaged. The reading is directly in thousandths of an inch clearance.



Mission Stairs Conserve Space

ALTHOUGH staggered stairs may sound like an architect's nightmare, they're a practical way of reaching a small upstairs room without utilizing too much floor space. Stairs of this type were often used in the old Spanish missions of the Southwest.

Pictured above are the stairs in the Spanish style custodian's home in a Texas state park. These were made from two logs of 24" diameter, one red elm and the other hackberry. After opposite sides were squared off, steps with a 12" tread and 12" rise were sawed the length of each log. Then they were installed in an offset manner.

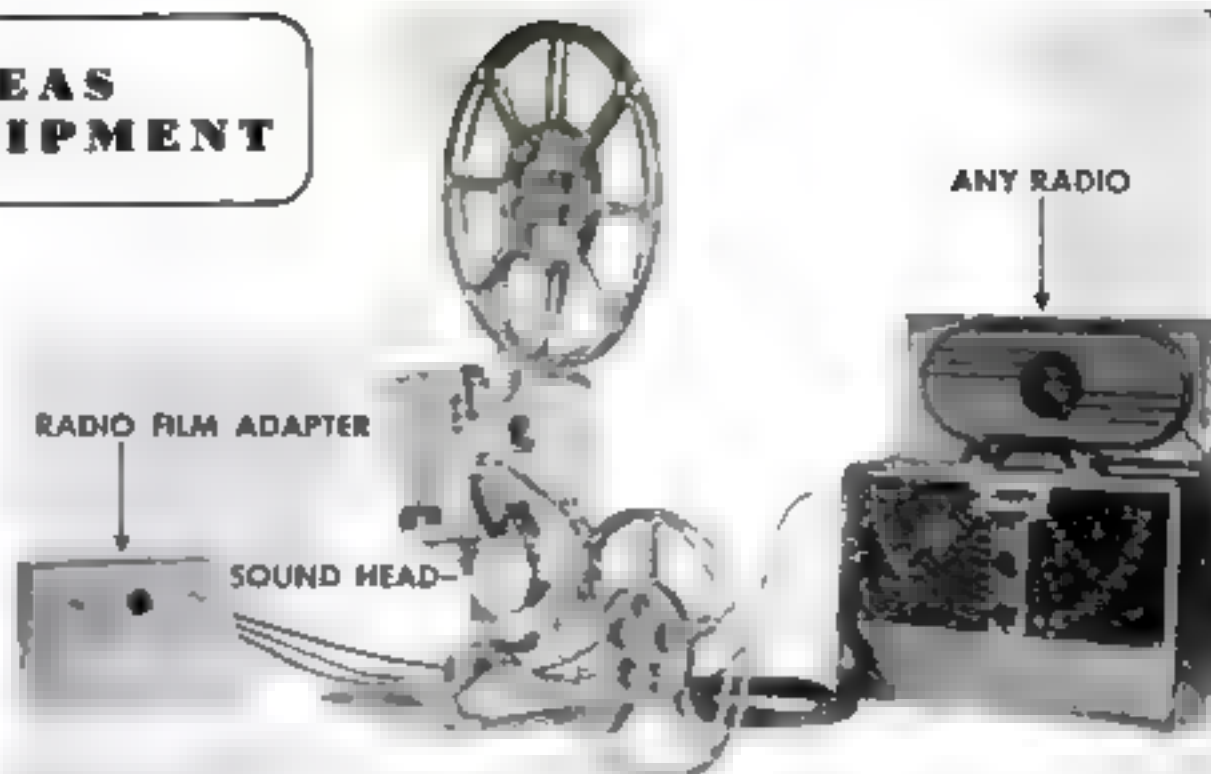
This gives the effect of a stairway with a 6" rise and 12" tread. However, the horizontal distance between the first riser and a vertical line from the landing is only half what a normal stairway of these dimensions would require.—ISABELLA H. ALDEN.



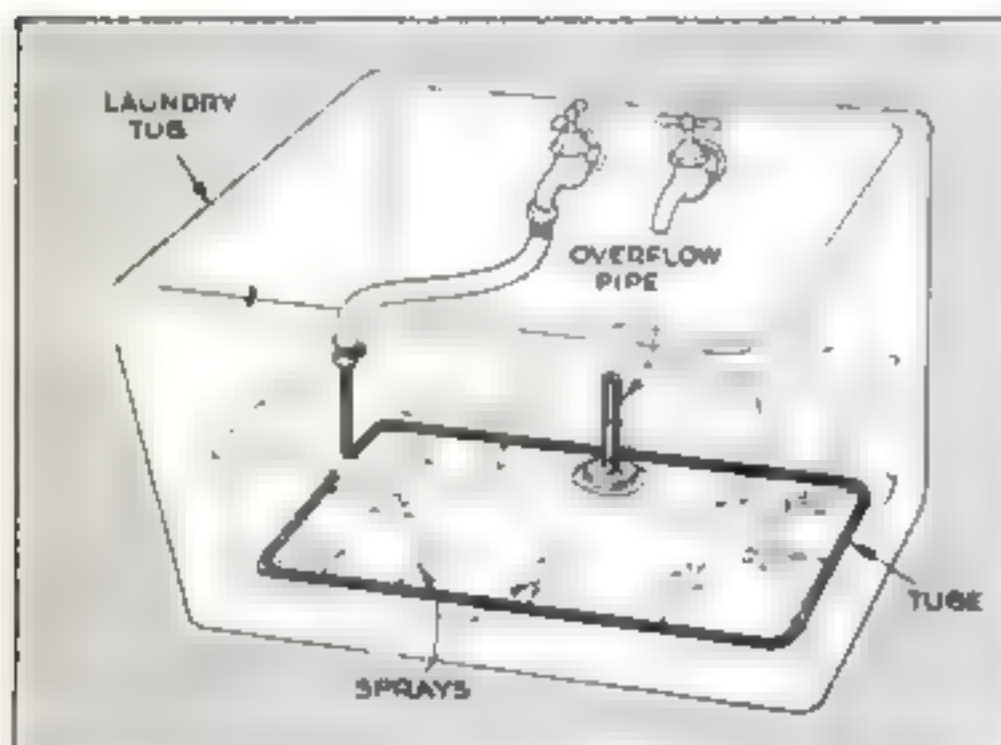
PHOTO IDEAS AND EQUIPMENT

Sound Projector.

With a sound head and adapter offered by the Apex Video Company, of Roscoe, Calif., you can add sound to any 16-mm. movie projector, using a radio as the amplifier. Costing less than \$60, the unit can be installed by any home-movie fan and readily removed at any future time. At the heart of the scanning system is a photoelectric tube that is said to give increased response and fidelity with low scanning-beam

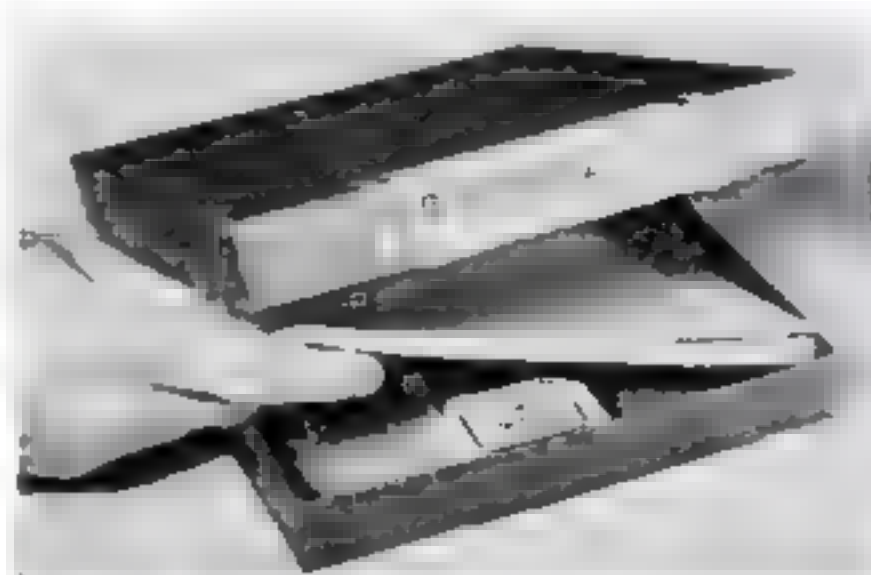


intensity. Other features include ball-bearing driven parts and an automatic wiper. For those who do not wish to use a radio, an amplifier and speaker are available.



Sprays Agitate Prints. Made from copper tubing, this print washer does a good job. The tubing was bent by hand around a piece of pipe, the tubing being moved a fraction of an inch after each of a succession of slight bends. In this way you can get a reasonably sharp bend without flattening the tube. Then No. 58 holes were drilled at intervals, being slanted slightly downward so the jets would keep the prints off the bottom of the tub. An overflow pipe was made by drilling a rubber sink stopper and inserting tubing.—J. W. GROSDIDIER.

Filter Improves Solutions. The chemicals that are often found in ordinary tap water and make it hard may be removed by using a portable filter made by the Sierra Water Softener Company, of Los Angeles. The water then is more suitable for mixing photographic solutions. Attached to a faucet by means of a hose, the filter provides a steady supply of soft water.

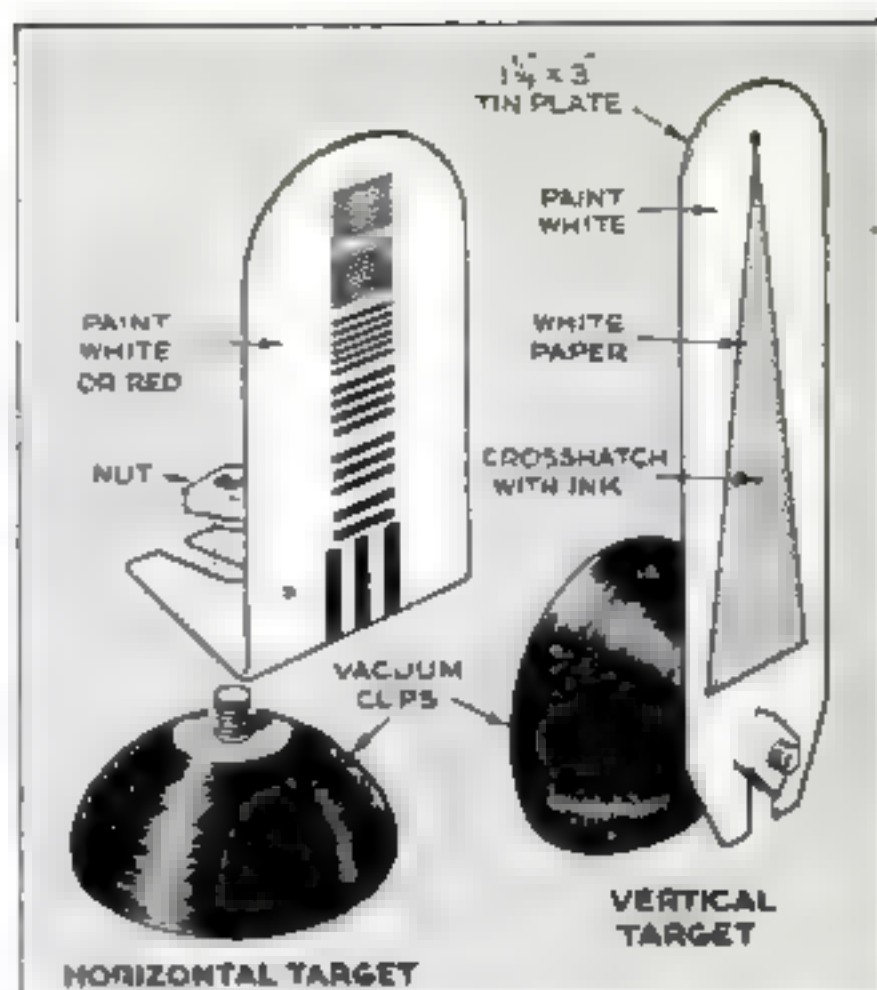


Don't Fumble for Paper. A small object inserted under a boxed supply of projection paper will facilitate darkroom routine. Since the object will keep the paper at an angle, you can get a sheet without fishing at the bottom of the box.



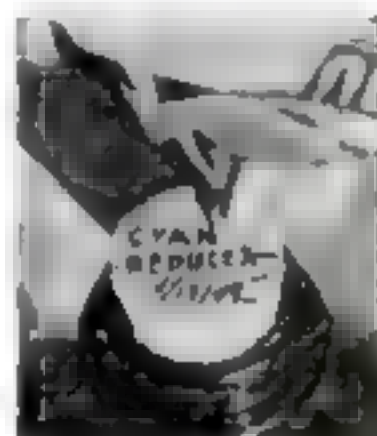
Targets Help You Focus. Three critical-focus targets mounted on vacuum cups are very useful for closeup photos, especially when the subject itself has no sharp lines to focus on. Two are placed in the horizontal plane to check the depth of focus. A third, moved about on the background, shows the area covered.

For the two horizontal targets above, variably spaced parallel lines were cut from Bureau of Standards lens-resolving charts, obtainable from the Superintendent of Documents, Washington, at 40 cents. To make the targets easily distinguishable on the ground glass, the border of one was painted

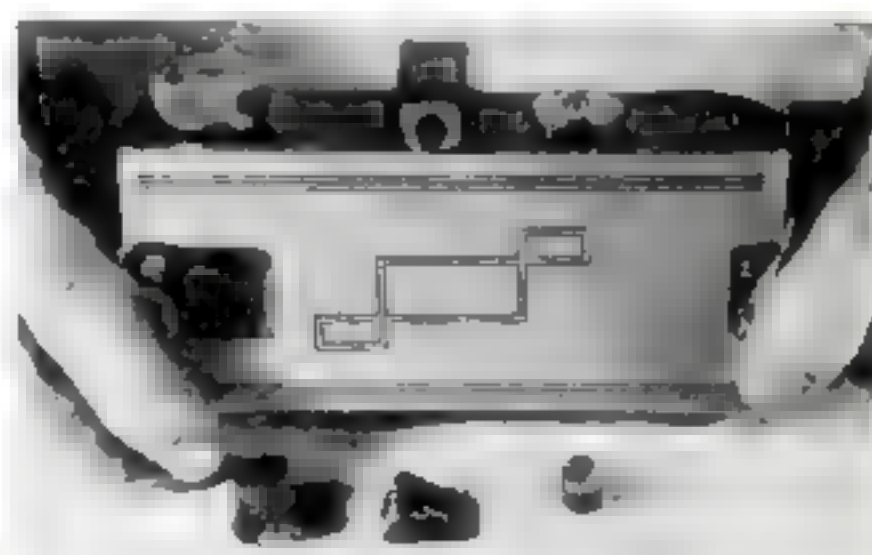


white, the other red, and chart lines run in opposite directions. Simple crosshatching with ink on a piece of white paper is suitable for the vertical target.—E. PETER SMITH.

Cork Labeled. A coat of cellulose cement spread over an ink label on the cork is a handy way of identifying solutions. The cement prevents the ink from being smeared or rubbed off.—J. WILSON.



New Camera Is Compact. Although smaller than the hand, a 35-mm. camera introduced by the Bolsey Corporation of America, New York, uses standard 35-mm. film cartridges. Equipped with an f/3.2 coated 44-mm. lens, a shutter with speeds up to 1/200th sec., and a coupled range-finder, it is priced at about \$50.



Cushion Protects Glasses. Photographers who wear glasses and use eye-level finders are likely to chip one of the spectacle lenses by bringing the finder against it. On a camera of the above type, this can be avoided by cutting a rubber ring from the neck of a slip-on eraser and cementing it to the finder.—HERMAN KLEIN.

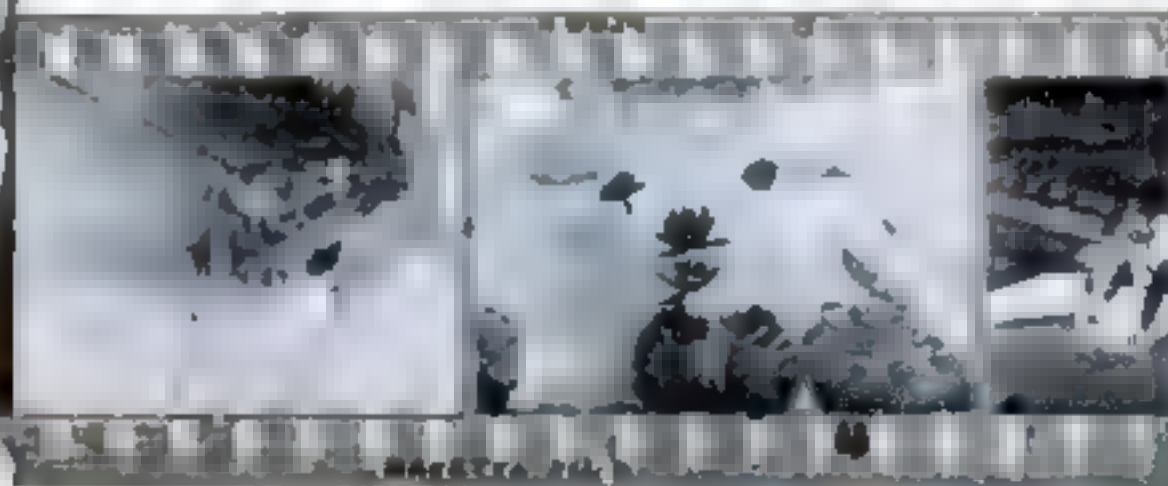


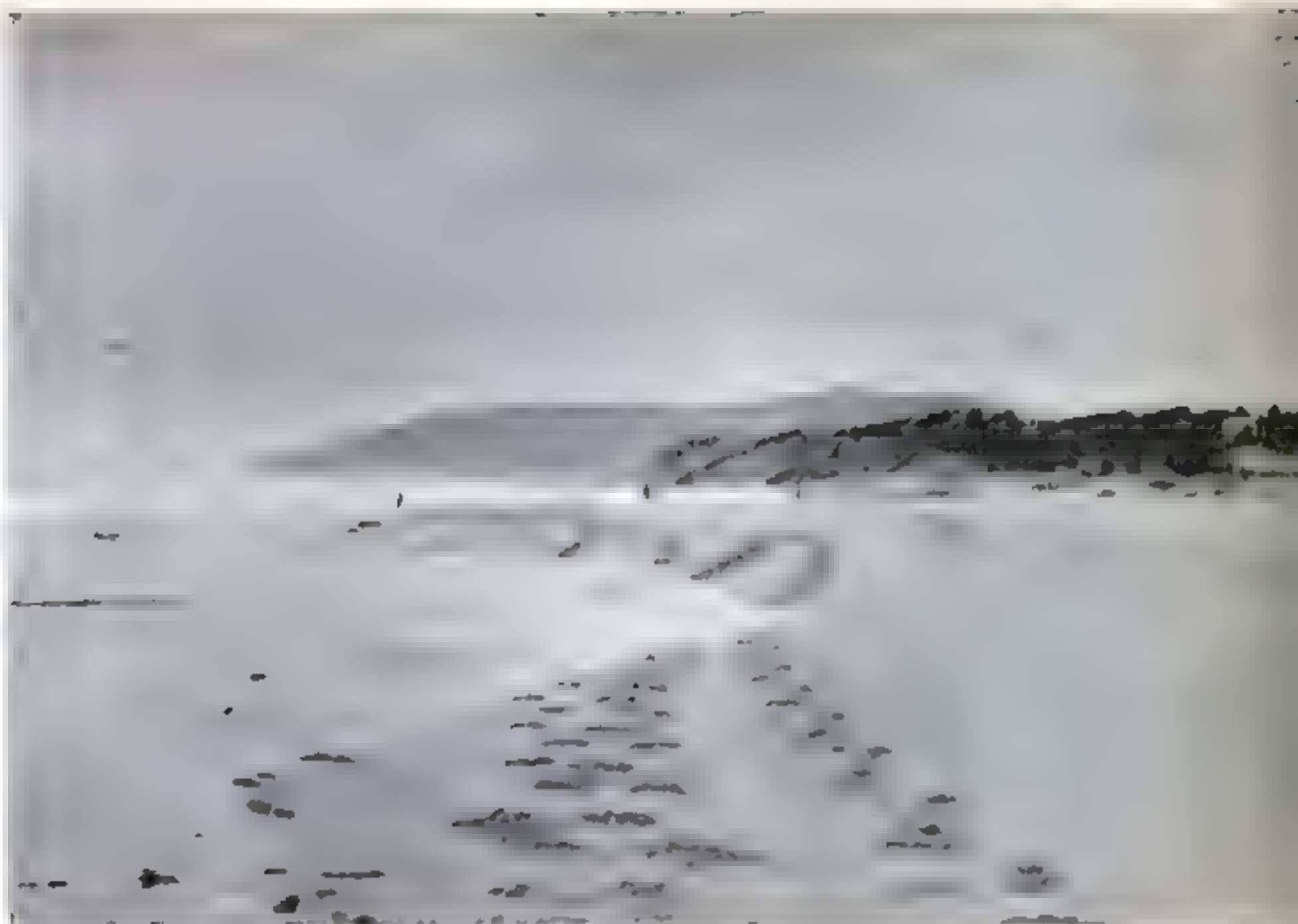
Enlargements of salon quality are possible, if you respect the limitations of the camera.

Your 35-mm. Camera Challenges Your Skill

By Margery K. Kendall

PHOTOGRAPHERS have been scrapping over the 35-mm. camera ever since the candid photo fad of the 1930's first brought it into prominence. One camp argues it should be left to gather dust on dealers' shelves. The other, while admitting certain





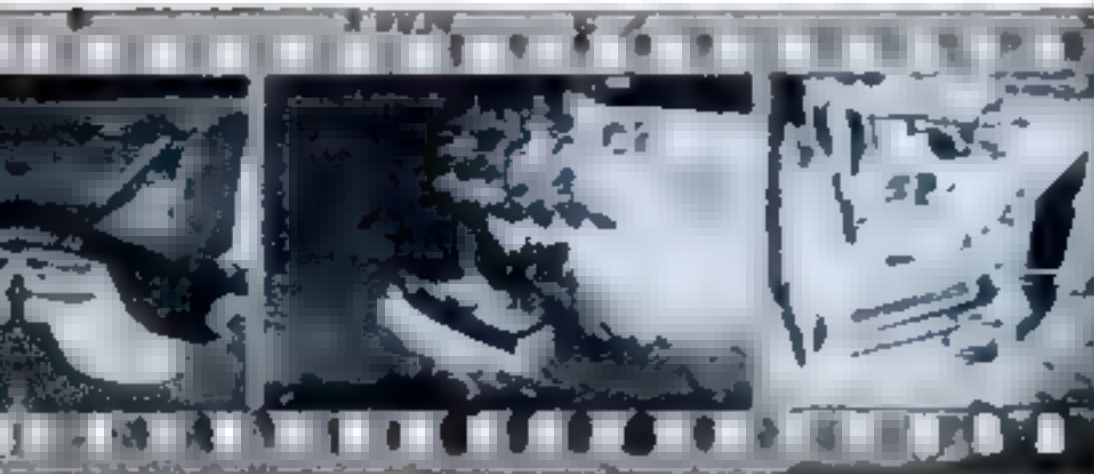
Composition should begin, and end, in the viewfinder: that is, put the full negative to work.

limitations, contends that it will produce topnotch work if properly used.

I belong to the latter group, and I'd like to say my say on the subject. As an example of the work the camera will do, I submit the photos that accompany this article. All have been blown up successfully to 11" by 14"

You should understand first of all that any good 35-mm. camera is a precision instrument. (We're talking here of the Leica type, not the many inexpensive, fixed-focus imitations.) Unless operated with the precision with which it was made, the miniature camera never will give good results—

Excellent candid shots of people are a cinch.





Backlighting and good composition give this a punch.

except by accident. If you shoot it the way a Sunday snaphooter does a box camera, you'll get just about the same kind of pictures, or worse.

In this demand for precise use lies a point in favor of the 35-mm. camera; for

the beginner who really wants to become a serious photographer and turn out prints of salon quality, there's nothing better than a 35-mm. camera.

Do I hear a clamor up there in the peanut gallery? Sure, I'm aware of the heresy I've just expressed. I know as well as the next one that the beginner usually is advised to learn all about a simple camera before graduating to anything as intricate as a Leica or Contax. But I disagree.

The miniature camera will not tolerate slipshod work. It demands your best. If you try to cut some of the corners that a simple camera may allow, sure as blazes you'll trip over your own shutter button and come up with nothing more than a fist full of useless negatives. But if you respond to the challenge that the camera presents, you'll find yourself learning. If you master the camera, you'll be well on your way to becoming a competent photographer. If you don't—well, perhaps you weren't cut out to be

a photographer anyway.

Even those photographers who are always knocking the miniature camera will usually agree there are times when its short focal length and fast lens are assets. In a theater, for instance, a 35-mm. camera often



Closeups like this water-lily shot are as much in the range of the camera as are landscapes.



Camera movement is always fatal. To get sharp photos, use a tripod or a similar support.

can catch a scene under adverse lighting conditions that might cause another camera to fail. And there is no denying that the small camera is inexpensive to operate, both for black-and-white and color. It's quite an advantage to be able to shoot a scene three or four times without worrying about film. For color slides, it can't be beat.

It is true that grain is the miniature camera fan's worst foe, but this can be minimized by using fine-grain film and de-

veloper, and then enlarging on rough or matte paper. Cropping also should be done in the viewfinder, rather than in the enlarger, for a piece of film the size of a postage stamp is small enough without making it smaller by using only a part of a negative.

Always use a tripod for exposures longer than 1/25th sec. When a large negative is blurred by camera movement, you usually can make an acceptable contact print. With a 35 mm camera, you're out of luck. END



Everything's in focus here—the people in the foreground and the planes in the distance.



Pocket Radio Doubles as Hearing Aid

By Albert Rowley

GUIDED by wartime needs and the ingenuity of parts designers, electronic components are getting to be so tiny that even electrons may soon feel cramped. Elsewhere in this issue you can see what manufacturers have in store in the way of miniature radios, hearing aids, and the like. For the experimenter who must work with standard parts, much of this is still out of reach. But if you can't quite compete with mass-production techniques, you can come pretty close with some of the pint-size parts that are now available.

The pocket radio and hearing aid described in these pages uses only four sub-miniature tubes in a dual circuit arrangement. When the switches are in one position, all four are incorporated in a super-heterodyne receiver. With two of the switches reversed, three tubes form a sensitive audio amplifier.

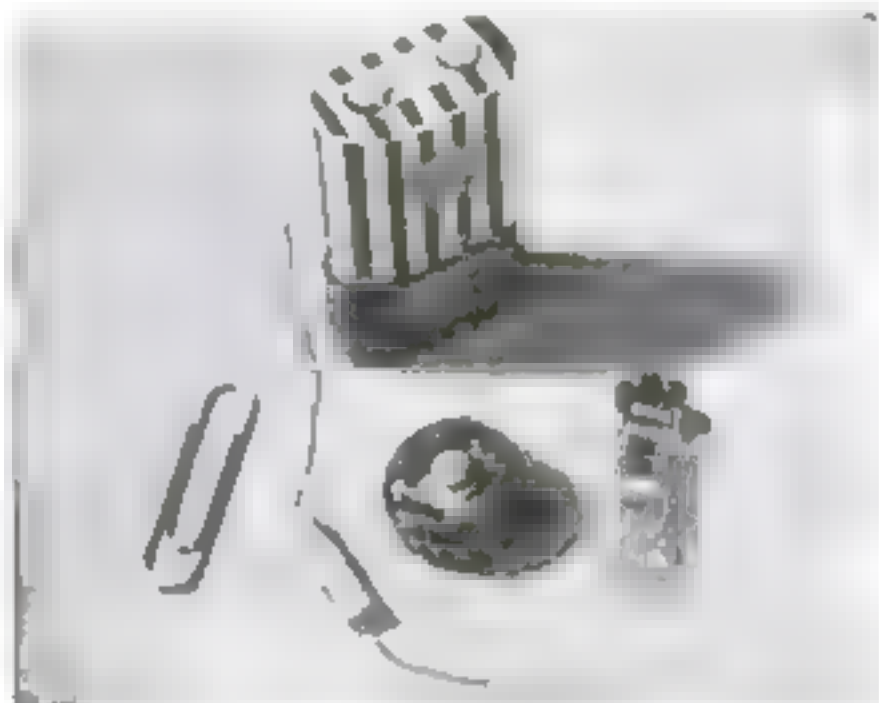
In the radio circuit the 2G22 acts as a



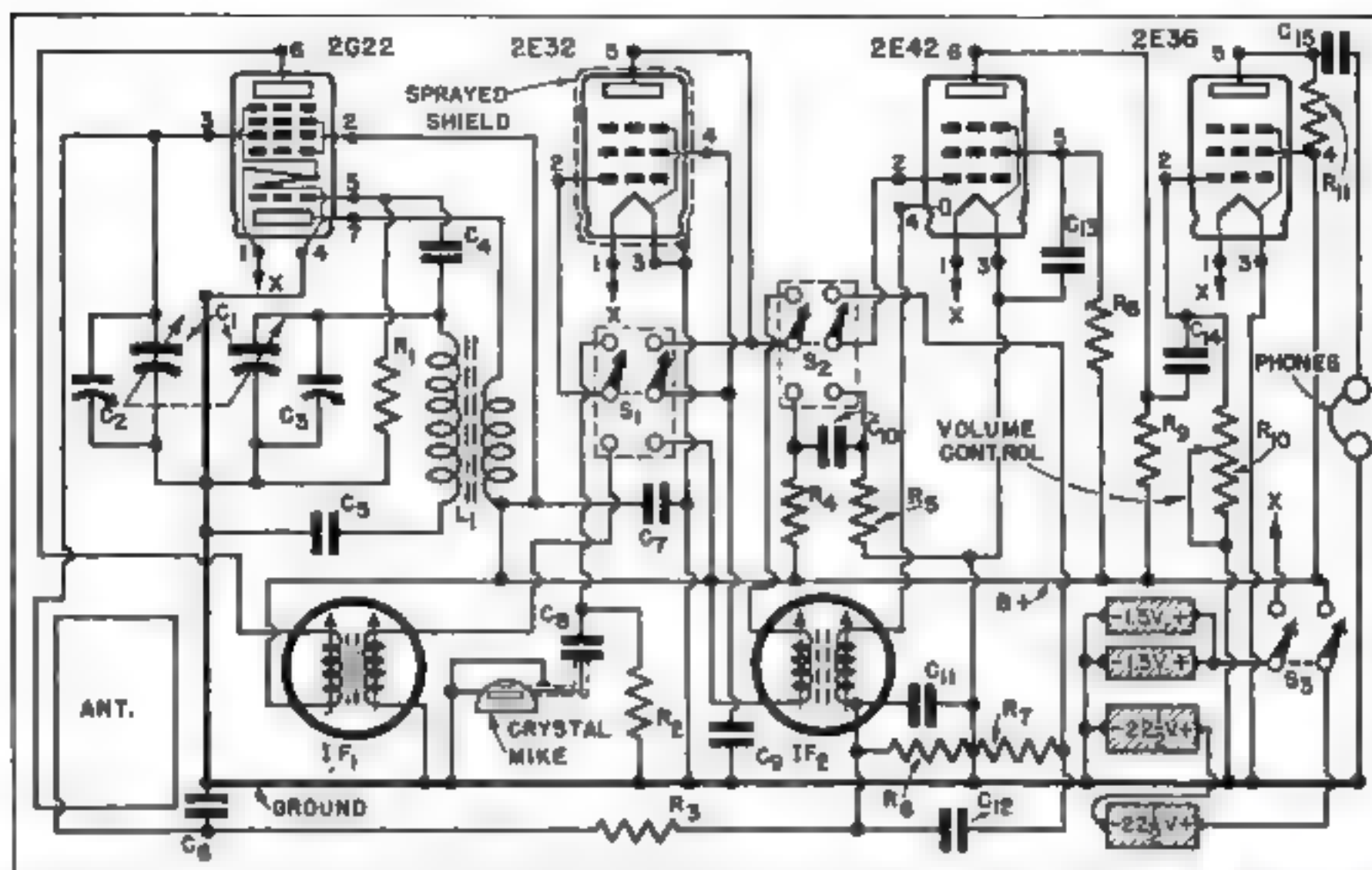
A crystal cartridge, together with its rubber lip. (See page 221 for details.)



Cut a hole in the wood to make a press fit for the rubber lip. The component fits into the hole.



A few of the tiny components. Note the small condenser, volume control, tube, and battery.



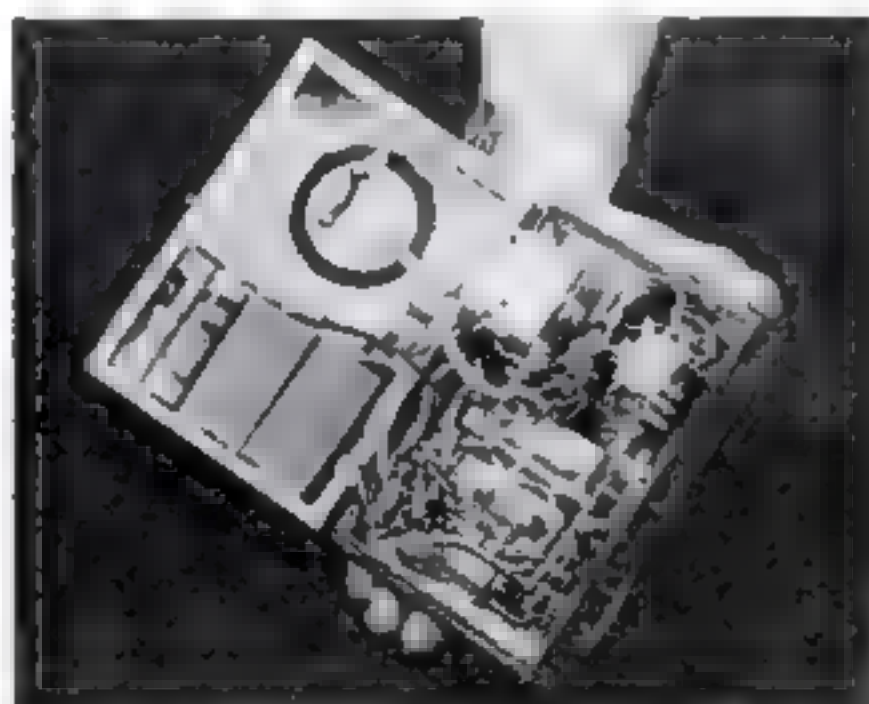
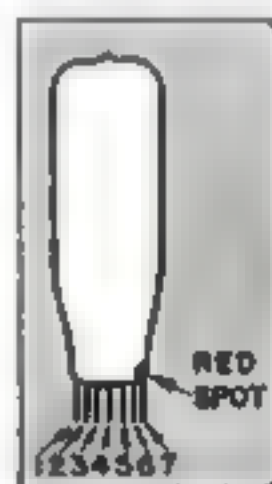
Tube-pin numbers are counted from the left when the red dot is at the right.

triode-heptode frequency converter; it is replaced by the microphone in the hearing-aid application. A shielded pentode RF amplifier, the 2E32 is used alternately as IF amplifier and first-audio tube. Next comes the 2E42, a diode-pentode which doubles as second detector and second audio amplifier. The 2E36 pentode is the output amplifier in both applications.

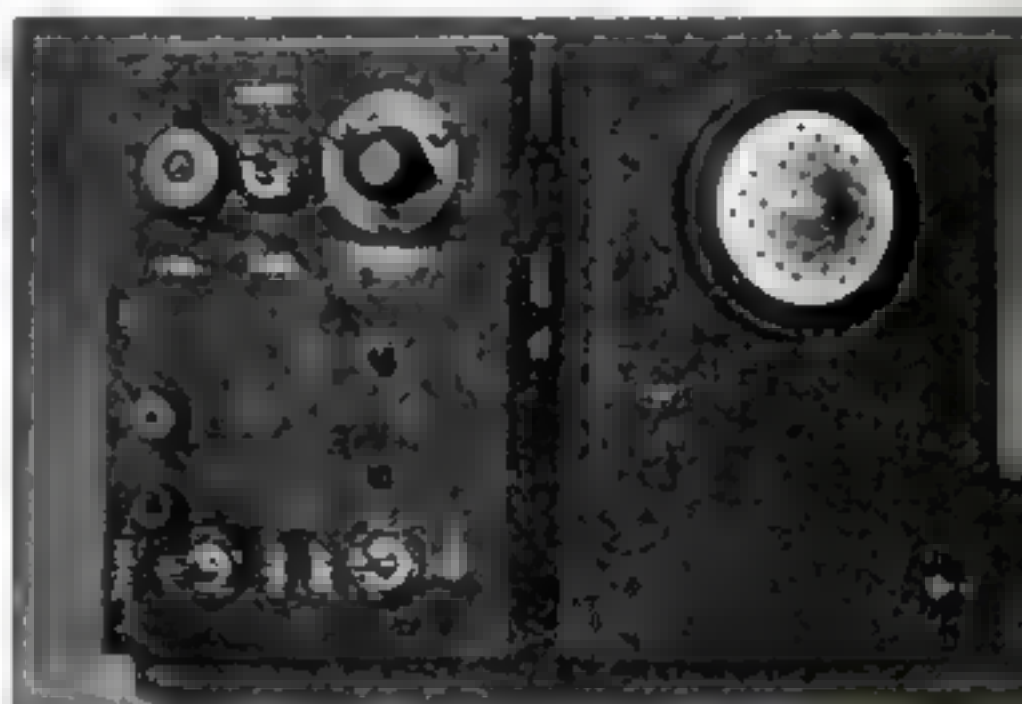
Proper assistance for the hard of hearing is something that may require the individual attention of a physician as well as the electronic designer. No attempt has been made here to correct for varying con-

ditions of deafness. All this hearing aid will do is amplify sounds at the microphone so that they reach the ear with far greater intensity. Many persons who are hard of hearing can use this instrument with advantage as an auxiliary—not as a substitute—for an expertly fitted device.

For those with normal hearing who fancy a pocket-size radio without the extra feature, it is a simple matter to omit the microphone and switches S1 and S2, making the



Interior of completed set. All parts except batteries, mike, and C2 are on the front panel.



Opened out, front and back look as above. Controls are on the front, mike on the back.



Placement of the parts is important for reasons of space economy rather than of function.

connections permanently in the radio position. The associated resistors and condensers can also be left out, thus making it possible to reduce the size of the case below the 1½" by 3½" by 5½" box needed to house the present components.

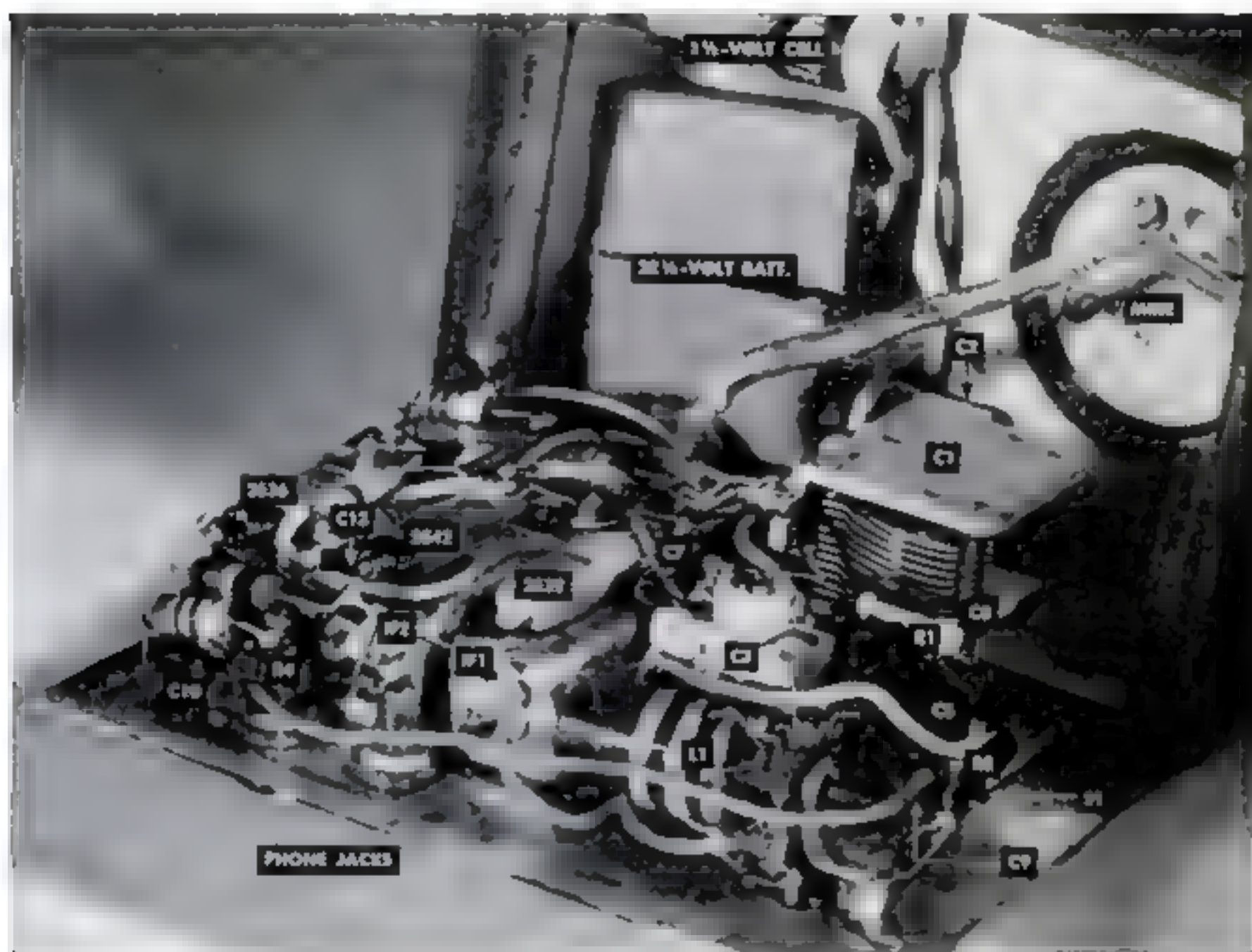
Two 1.5-volt penlight cells in parallel supply the filament voltage for the tubes. As these must be changed quite often, a clip bent from aluminum or other metal should be used to permit easy insertion of replacements. The pair of 22 5-volt batteries that furnish the 45 volts of B-plus last longer and can be soldered in. Other miniature parts used in this set include paper tubular condensers about the size of a ½-watt resistor, IF-transformer cans ¾" square, and a volume control in which the carbonized element is contained inside the tiny knob.

A loop antenna consisting of 30 turns of No. 28 enameled wire is wound around the case and held in place by a layer of cloth tape. One side of the loop is connected to pin 3 of the 2G22 converter and to the antenna section of the two-gang tuning condenser, C1. The other side of the loop goes to the chassis through a condenser. The in-

coming signal is mixed with a frequency generated by the oscillator circuit to create an intermediate frequency of 456 kc. This is amplified by the 2E32 IF tube. Coupling between the converter, IF, and second-detector stages is accomplished by the IF transformers.

The larger of the two oscillator-coil windings is connected in series with C5, a .0004-mfd. fixed mica condenser that acts as a padder. This condenser, plus the proper adjustment of the iron core of the oscillator coil, permits this circuit to track at the proper frequency above that to which the antenna circuit is tuned.

Two midget IF transformers, mounted in cans measuring only ¾" square by 2" long, are fastened directly to the chassis—which is the reverse side of the front panel—by means of small machine screws. Like the oscillator coil, the IF transformers are tuned by adjustable iron cores. Since the tuning of these transformers is extremely broad, it is not necessary to use a signal generator in aligning the set. Once a station is tuned in, the cores can be adjusted by ear to maximum volume.



The general layout shown is recommended; if you must vary it, plan your changes carefully.

To get all the necessary parts into the small space allowed, it is important that you plan the layout with care. The photographs indicate the location selected for most of the items; where you deviate from this it is a good idea to try out the major units before making permanent connections.

Another consideration in building this set is that some of the components are placed directly on top of others. It is therefore necessary to complete all soldering on the

first layer before placing the next one on top. Switch S1, for example, is mounted between C1 and the oscillator coil, and wiring to it must be completed before the 2G22 is placed above it. The same holds true for the volume control, R10, since the oscillator coil and padder condenser are mounted on top of it. Wiring to the other two switches must be completed before the 2E36 is put in place.

Since they are so small and light, no sock-

LIST OF PARTS

C1: Two-gang midget tuning condenser, .00036 mfd. each section
C2, C3: 0 to 50-mmfd. trimmers.
C4: .0002-mfd. mica
C5: .0004-mfd. mica (used as padder).
C6, C7, C8, C9, C10, C12, C13, C14, C15: .005-mfd. paper tubular, very small.
C11: .0001-mfd. mica.
R1: 100,000-ohm, $\frac{1}{2}$ -watt carbon.
R2, R9: $\frac{1}{2}$ -meg., $\frac{1}{2}$ -watt carbon
R3, R5, R6, R7, R8: 1-meg., $\frac{1}{2}$ -watt carbon.
R4: 200,000-ohm, $\frac{1}{2}$ -watt carbon.
R10: hearing-aid volume control (carbon element enclosed in knob) $\frac{1}{2}$ meg.

R11: 40,000-ohm, $\frac{1}{2}$ -watt carbon.
Ant: 30 turns No. 28 enameled wire wound around case
IF1, IF2: Iron-core 456-kc. IF trans. mounted in cans $\frac{1}{2}$ " square.
L1: Adjustable iron-core oscillator coil.
S1, S2: DPDT toggle.
S3: DPST toggle.
Crystal microphone (lapel type, or cartridge removed from housing); headphones (crystal or magnetic); four subminiature tubes (one each, 2G22, 2E32, 2E42, 2E36); penlight A cells, miniature-22 $\frac{1}{2}$ -volt batteries, misc. hardware.



One of the newer pen-size soldering irons is almost essential for work on this midget set.

ets are required for the tubes. They are held in position by strips of cellulose tape plus the soldered connections to the pins.

A high-impedance lapel microphone would probably be most satisfactory for use in the hearing-aid portion of this set, but a very suitable—and much less expensive—substitute can be found inside an ordinary crys-

tal-mike housing. The photos show how the cartridge was removed from its bullet-like shell and fastened inside a hole in one side of the box that holds the set. The rubber cushion around the crystal unit must be left on to protect the microphone from vibration. It is fastened with rubber cement.

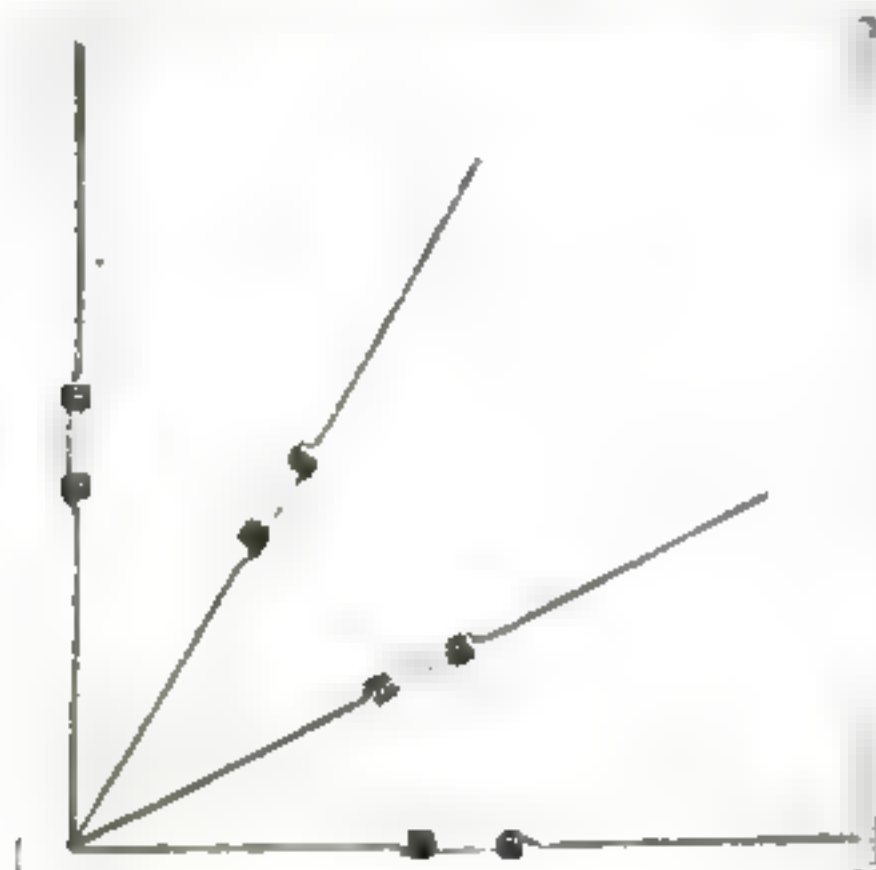
For other applications you may find it more desirable to keep the mike entirely separate so that it can be placed in a desk stand or worn on the clothing. Either way, the cable should be shielded.

At the other end of the circuit, ordinary high-impedance headphones of the crystal or magnetic type may be used. A single phone gives adequate results.

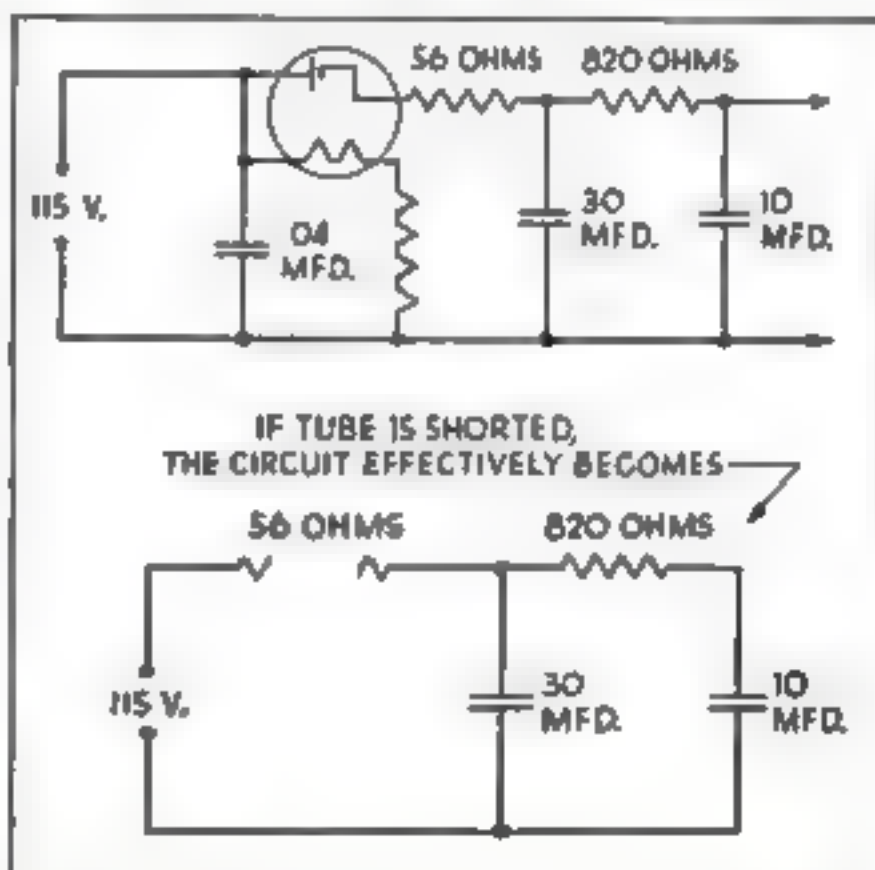
While there is nothing intrinsically difficult about the construction of this set, it cannot be built to size unless you are careful to obtain the very smallest parts. Also, it will take all your skill and experience with a soldering iron and the best workmanship you can put into it.

To make the unit completely self-contained, the external antenna and ground are omitted in favor of the case-wound loop. An antenna coil and aerial can be substituted if the conditions of use permit. Pick-up will, of course, be improved. Using only the loop shown, however, stations as far off as 400 miles were brought in clearly. **END**

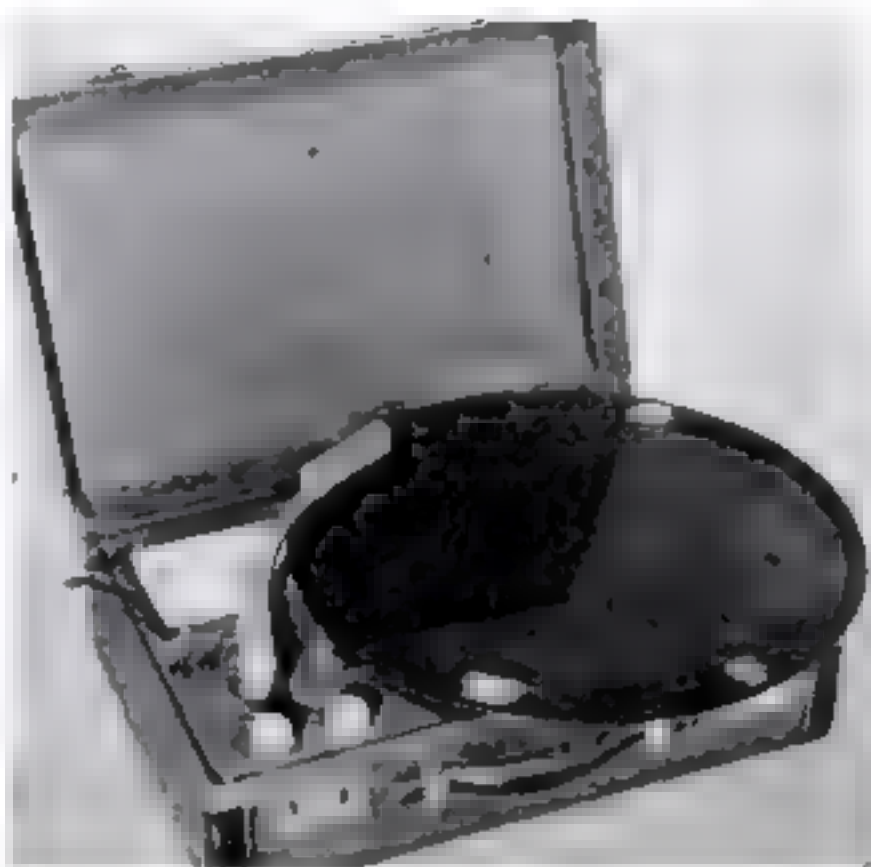
New Wire-Wound Resistors Open up on Overloads



FUNCTIONING as an ordinary resistor at low power levels, a fuse resistor developed by International Resistance Co., Philadelphia, opens a circuit in the event of a short or overload. The diagram illustrates one



function in the rectifier circuit of an AC-DC receiver. If the tube shorts, the line voltage will open the 56-ohm fuse resistor, thus reducing danger of fire and protecting the electrolytic condenser.

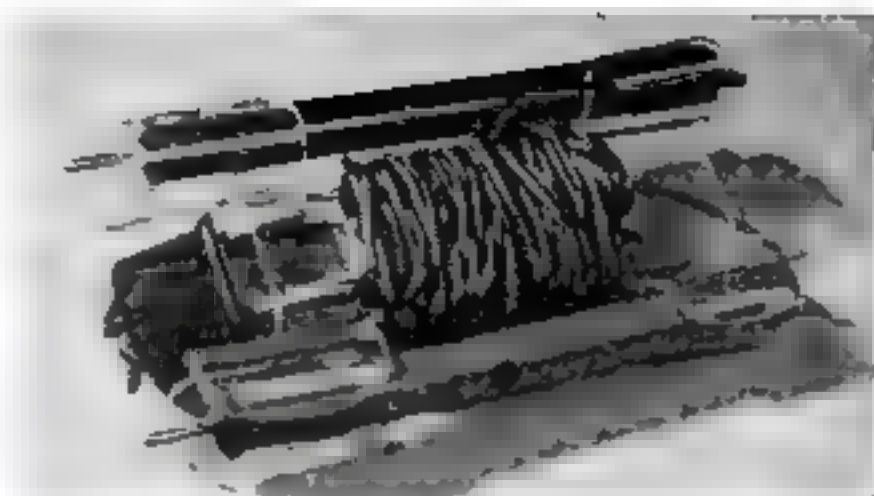


Player Polarizes Itself on DC.

A portable transcription player, designed principally for use in the field by radio and advertising men, features an AC-DC amplifier in which polarity does not have to be checked for use on direct current. It plays recordings up to 16" in diameter at either 33 $\frac{1}{3}$ or 78 r.p.m.

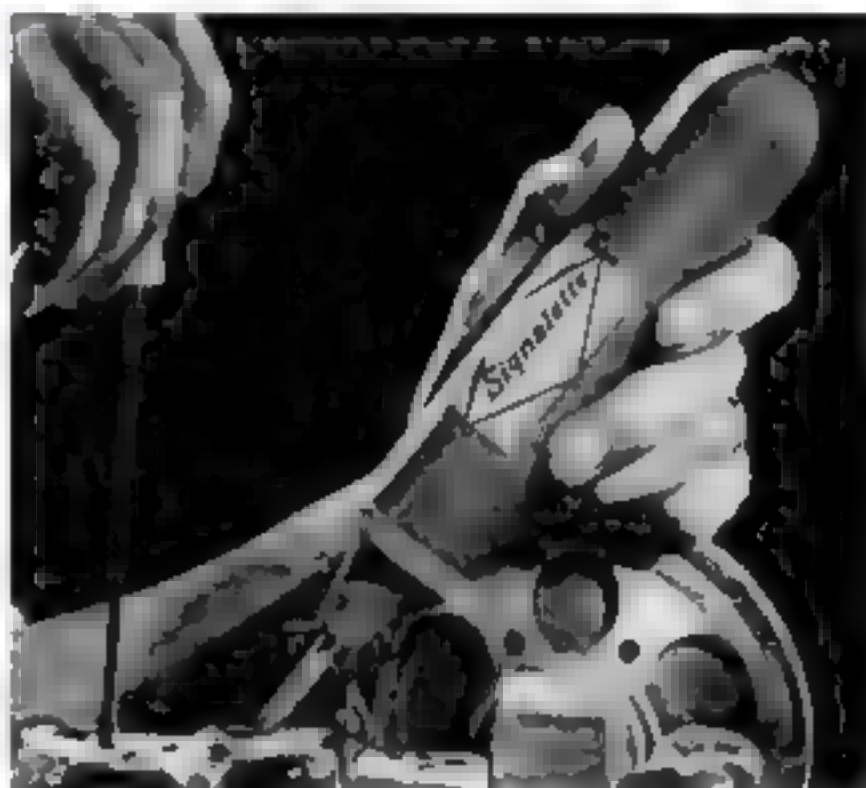
Automatic switching from AC to DC is accomplished by means of two DC relays. One relay diverts DC through a converter to the motor; the second, in conjunction with a selenium rectifier, adjusts the polarity to the amplifier. If the polarity is correct, the rectifier does not conduct, and the relay remains inoperative. If polarity is incorrect, the rectifier becomes conductive, closing the relay and reversing polarity. The unit is made by U. S. Recording Company, Washington, D. C., and is priced at \$140.

Ceramic Capacitors. Developed during the war, ceramic condensers are being used interchangeably with both the paper and mica types in many applications. They are smaller than either and slightly cheaper than mica. Electrical Reactance Corp., Franklinville, N. Y. makes a range from 5 mmf. to about .02 mfd. in both a general-purpose and a temperature-controlled type. The latter is held to 1-percent accuracy. In the left-hand column of the photo are a .001-mfd. paper, and a .0005 and .00025 mica with equivalent ceramics.



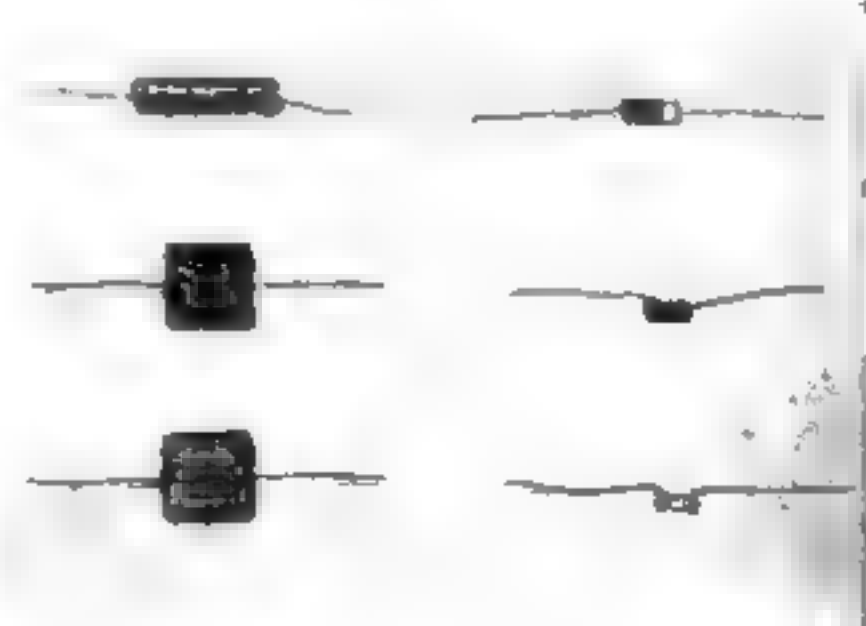
Neon Tester Shows Continuity.

The glow lamp in one of the prods of this tester indicates the presence of medium and high voltages in the usual way. It also checks electrical continuity. Star Fuse Co., New York, is the maker.



Signal Generator Is Hand Size.

To help servicemen test and align receivers away from the shop, Clippard Instrument Laboratory Inc., Cincinnati, makes this mid-gut multivibrator. Its signal, modulated by the 60-cycle supply, operates at a fundamental frequency of 2.5 kc., and is said to have usable harmonics up to 20 mc.



How Evaporation Steals Heat

EVERY time a liquid evaporates into a gas, it snatches a definite amount of heat from its container and surrounding air, cooling both below their original temperatures.

This law of physical chemistry has long been useful to the human race as a means of cooling foods or drinks. Primitive man found that water placed in unglazed earthenware vessels would seep through the pores, evaporate, and cool the water remain-

ing inside. Campers and country dwellers still cool water in this way.

Today, all our mechanical refrigerators, electric and gas alike, harness the cooling effect of evaporation. Alternately compressed into a liquid and allowed to expand into a gas, the refrigerant absorbs heat during each evaporation cycle.

The following experiments demonstrate how evaporation lowers temperatures.



Ether Freezes Water. Since some liquids vaporize at a lower temperature than water, they produce a correspondingly greater degree of cold. Ether is such a liquid.

This may be shown by filling a test tube about a third full of ether. After equipping the tube with a two-hole stopper, insert a length of bent glass tubing until one leg almost reaches the bottom. Into the other hole thrust a short delivery tube fitted with rubber tubing long enough to carry the ether vapor out an open window.

Now moisten the outside of the test tube with water and blow steadily into the inlet tube. The ether will quickly evaporate and ice will form on the test tube.



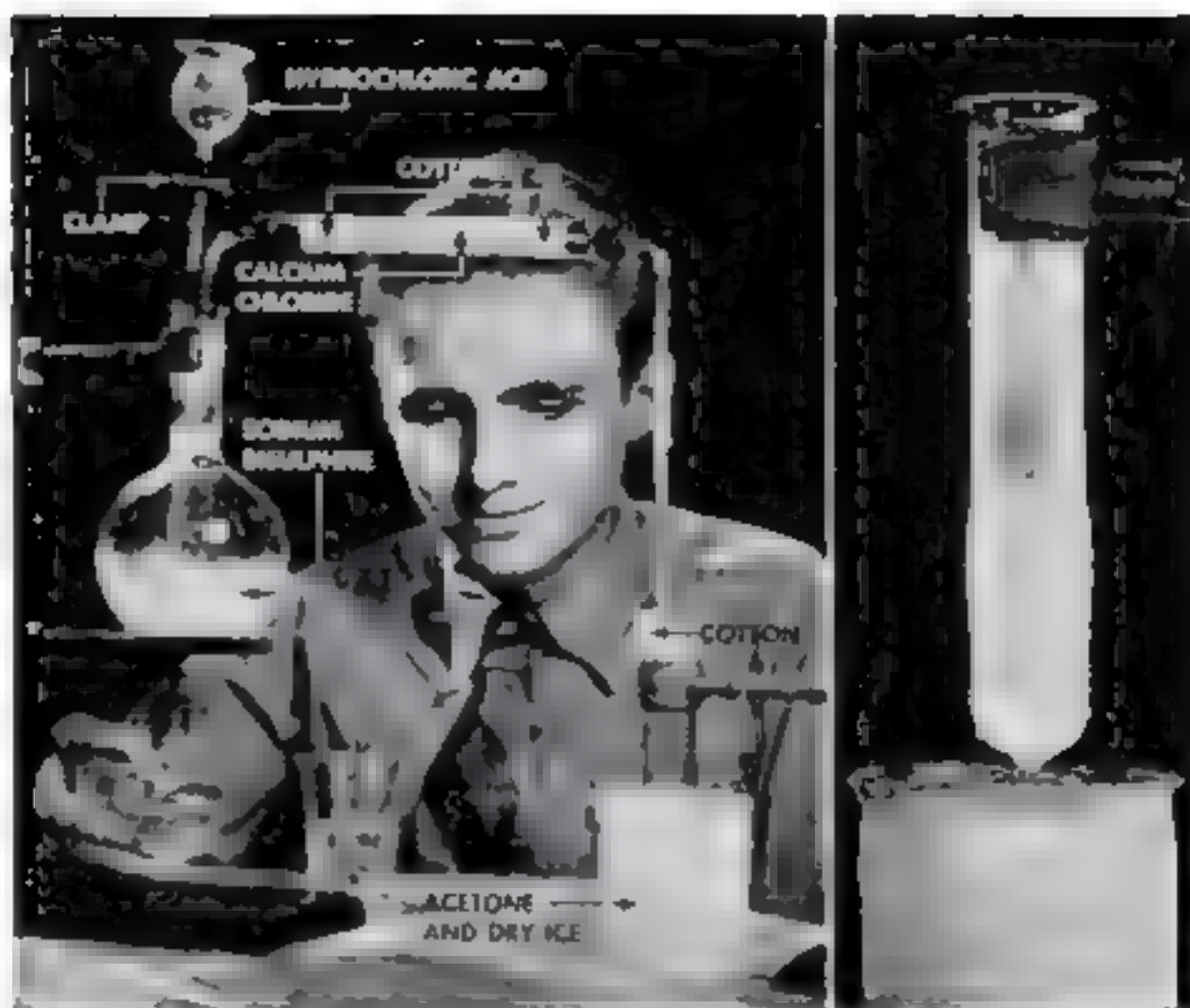
Insecticide Produces Frost. Some liquids evaporate at temperatures even lower than ether. An example is dichlorodifluoromethane, a liquefied gas used for refrigeration and in insecticide bombs.

With such a bomb, you can easily see what spontaneous evaporation of this chemical will do. Hold the end of a glass tube, bent into a coil or zigzag shape, to the nozzle while the bomb is in action. (Be sure you hold the tubing with a pair of tongs or a spring clothespin, for any liquid accidentally sprayed on your fingers might freeze them). Evaporating and expanding as it escapes through the tube, the chemical quickly causes frost to form on the outside.

Liquefying a Gas.

In an electric refrigerator, a motor-driven compressor liquefies a refrigerant gas, such as sulphur dioxide, by squeezing it powerfully. For purposes of experimentation, you can liquefy this gas by subjecting it to intense cold.

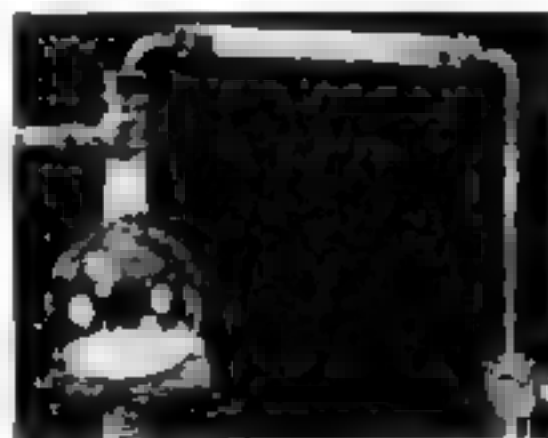
To generate the gas, put 15 grams of sodium bisulphite into a flask arranged, as at the right, with dilute hydrochloric acid (1 part acid to 2 parts water) in a dropping funnel above it. To dry the gas, fill the horizontal tube with lumps of calcium chloride, packing cotton loosely in each end before inserting stoppers with entry and exit tubes. Lead the latter into a large test tube supported in a freezing mixture made by filling the beaker half full of acetone and adding dry ice slowly. (Caution: keep your fingers away from the mix-



ture.) Now open the clamp, allowing acid to fall drop by drop, and apply gentle heat.

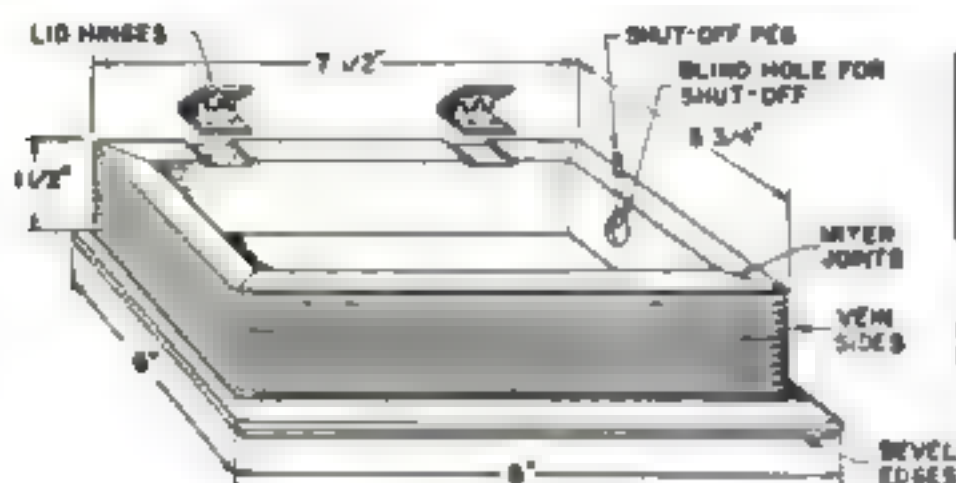
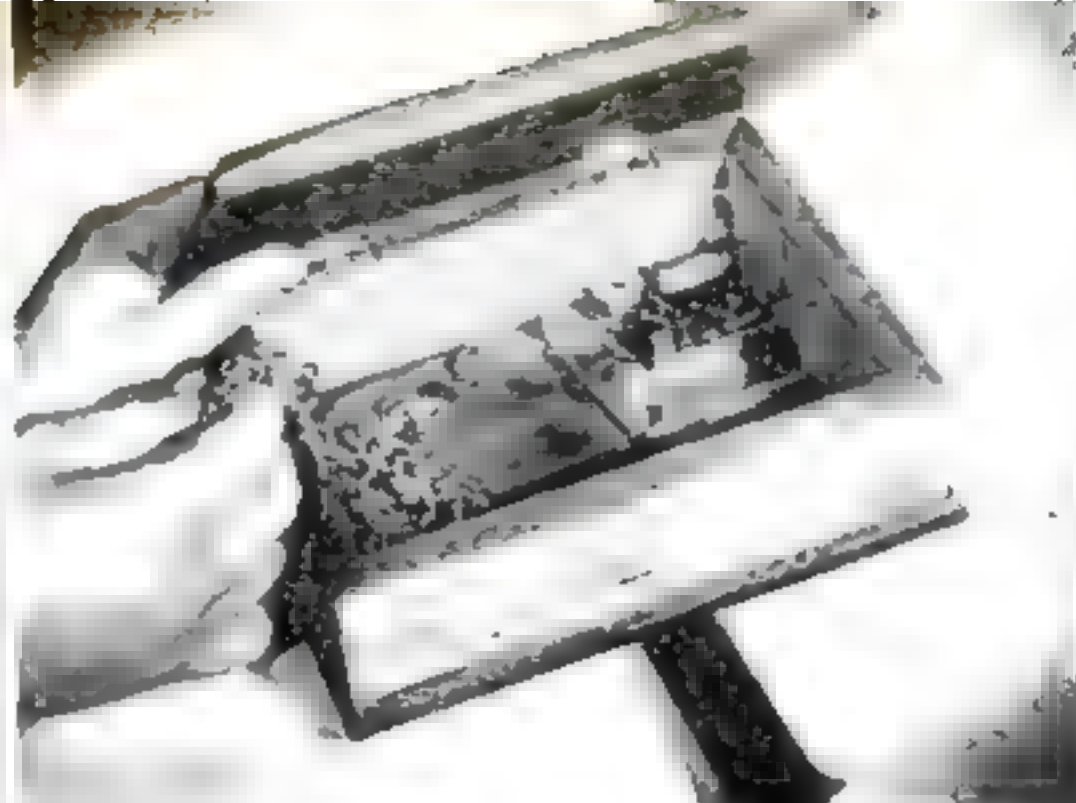
When a quantity of liquid sulphur dioxide has collected, lift the test tube from the freezing mixture in a well-ventilated room. The liquid will quickly evaporate, forming frost as at the right above.

Gas Refrigerator Uses Ammonia. Altered as at the right, the apparatus will generate and liquefy ammonia, the refrigerant found in gas refrigerators. Put in the flask a dry mixture of 15 grams ammonium chloride and 30 grams of calcium hydroxide, insert a one-hole stopper, and in the drying tube place a loose layer of calcium oxide. Omit the hydrochloric acid; gentle heat will start the reaction. When some liquid ammonia has collected, remove the test tube from the freezing mixture. Again, frost will form.



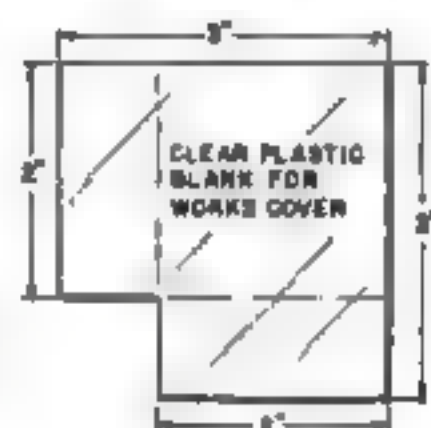
Chemicals Produce Cold. A few ounces of ammonium nitrate crystals will show that cold also may be produced chemically—merely by dissolving certain substances in water. A commercial device for cooling bottled beverages on picnics makes use of this principle.

To demonstrate how it works, put a few drops of water on a block of wood or a cork coaster and set a thin-bottomed glass on the water. Then put equal amounts of cold water and ammonium nitrate into the glass and stir rapidly. The coaster will freeze to the bottom of the glass. In dissolving, the chemical absorbs heat from its surroundings.



BOX CONSTRUCTED FROM 1/2" WALNUT

HEAT & BEND CLEAR PLASTIC TO THIS SHAPE



Album Jewel Box Has Hidden Music Movement

REMEMBER Grandma's old red-plush photograph album? If you do, this jewel box may strike a nostalgic note—and a tinkly tune as well, for it has a music-box movement. Housed under clear plastic, the movement can be seen as well as heard.

Ideally the lid and bottom of the box should be $\frac{1}{2}$ " walnut or other hardwood that can be nicely finished. Bevel all edges of both to give the appearance of a padded cover. The word "album" is cut from walnut veneer and glued on. Make the box frame of four pieces, with miter joints. Vein the two ends and the front with a wood-carver's veining tool, sharp chisel, or even a

sharp awl to resemble pages of thick paper.

Mount the works so that the shut-off wire enters a blind hole in one end. Drill a hole for a small dowel, which will press down the wire when the lid is closed. Rout a recess in the bottom to accommodate the winding key. Cut a 3" square of clear plastic as shown and shape it over a 2" by 2" wooden block after softening it in the oven. Three brads driven into the box will hold it in place.

The strap and lock clasp came from an old diary and a man's leather belt respectively. Stain and wax the cover, and gild the sides to simulate gilded album edges.

Electric Shaver Converted to Power Eraser

DRAFTSMEN and others who do a lot of drawing will find an electric eraser a timesaver. Mine was made from an old electric shaver of the rotating-shaft (not the vibrator) type.

Clean and adjust the mechanism if necessary to make the motor run as fast as possible. Then replace the cover, remove the head, and cut or grind off the shoulders of the housing that form the cutter-head slot. Also grind off the cam at the end of the shaft that actuated the cutter. Solder a sleeve on the shaft (mine consisted of two dry-cell nuts reamed out to fit) and on it push a slip-on cap eraser. Point it by running the motor and holding the eraser against sandpaper or a grinding wheel.—F. W. ARWOOD.



Wallpapering Your Floor

By Julia G. Barkley

Photos by Dean Babcock

FLOORS get stepped on in more ways than one. Not only do we walk all over them, but we rarely take them into account in any decorating schemes. With half a chance, however, the floor can give a new lease on beauty to a commonplace entrance hall, dining alcove, or living room.

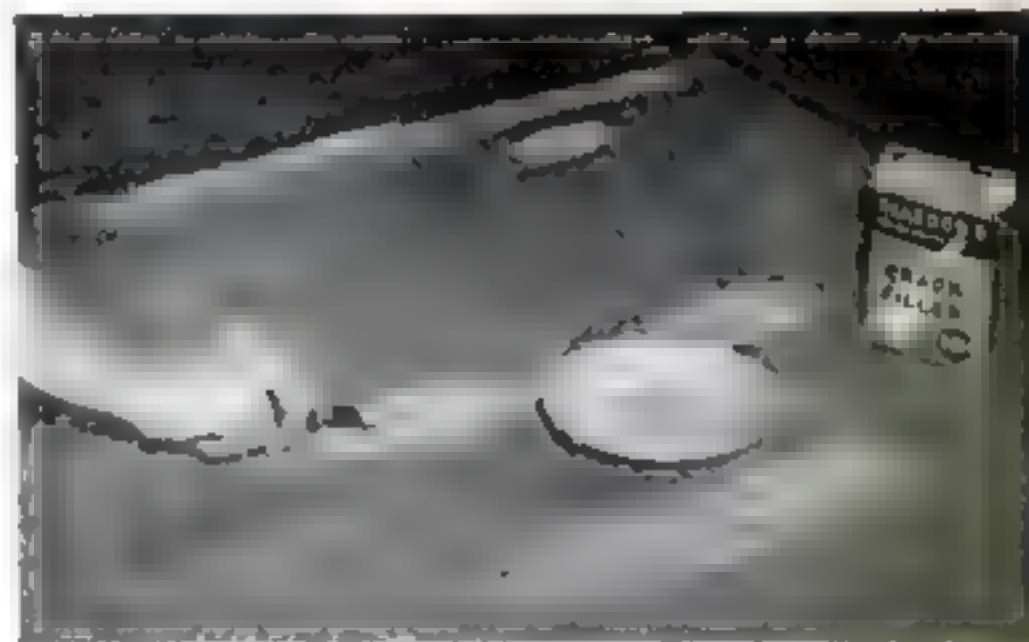
Probably the notion of walking on wallpaper strikes you as impractical. But with a good protective coating, paper makes a remarkably durable surface. In one public model home, such a floor was walked on by hundreds of people daily for five months without showing perceptible wear.

Choose a paper having a minimum of white in the pattern, since the protective coating may darken clear white. Next, make certain that the surface is flat and smooth. Cracks should be filled and sanded. It is then advisable to seal the surface with a preparatory coat of shellac.

Select a tough-fibered paper and apply it with ordinary wallpaper paste. Match the stripes or designs carefully as you would on a wall. After the paste has dried, apply two coats of clear shellac and one of varnish. Allow each coat to dry before putting on the next. Protect the finished job with three coats of wax, buffed between applications.



Matched to the paper on the wall, the papered floor makes this hall look larger and brighter.



Fill in all cracks and irregularities in the floor, and sand the entire surface perfectly smooth.



Apply wallpaper paste to the floor and paper. Match the design carefully as you add strips.



To protect the paper, cover it with two coats of shellac, one of varnish, and three of wax.



Cabins Clad in Aluminum



Weatherproof sheet metal permits a low roof pitch. Joists and studs alike are set 24" apart.



Cutting corrugated sheet on an 8" table saw. Lightness makes it easy to handle and to set up.

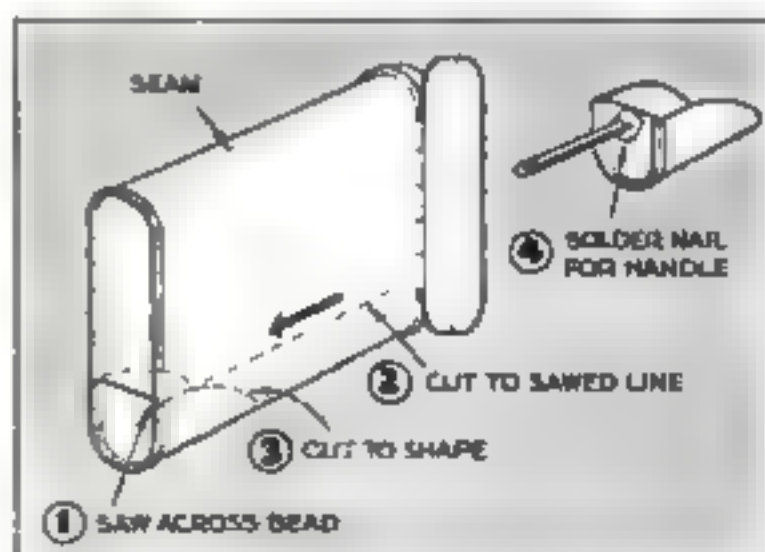
ONE way to beat certain material shortages in building is to use sheet aluminum for roofs and outer walls. Now plentiful, the metal is easy to fabricate on the site. It is being used on the West coast for vacation cottages as well as for emergency housing.

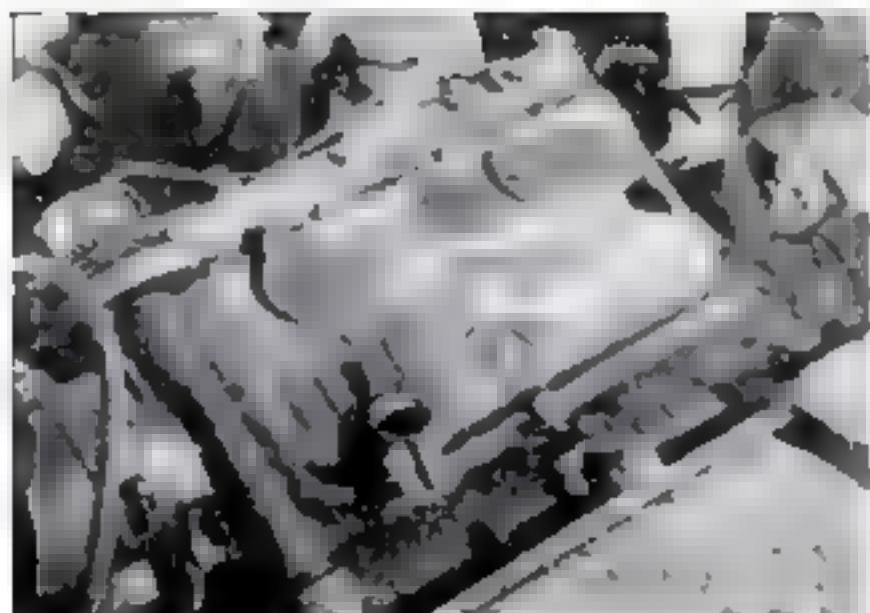
The chief types used in building small cottages like that shown above are 8" clapboard-style siding and corrugated sheet for roof and trim, in thicknesses from .019" to .027". Standard channel sections are used for corner posts, eaves troughs, and downspouts. An 8" aluminum-cutting circular saw and a cutoff saw do the entire job of trimming sheets to size on the spot.

Siding is nailed to two-by-fours spaced on 24" centers, as are rafters and joists. Corrugated roofing is laid on 1" by 4" sheathing spaced 4" apart. Building paper is placed under the aluminum to insulate the walls and to minimize drumming on the roof. Precut materials for a 24' by 24' cottage (above), exclusive of interior finishing, run \$900 to \$1,200. Built on a concrete slab, it has space for living room, bath, bedroom, kitchen nook, and closet.

Midget Scoops from Tobacco Cans

For handling plaster-of-Paris, dry glues, and similar materials in the workshop, a tiny scoop is just the thing. You can make as many as you need from oval tobacco tins, and have a separate one for each purpose. With a fine-tooth hacksaw blade cut across the bead on the bottom first. Then use tin snips or heavy shears to cut along both sides of the can to the saw cut. Shape the scoop to the form you fancy, and then solder a nail to the back as a handle.—MAK CLEMENTS.





A piece had fallen out and there were 37" of cracks in the block at the beginning of the job.



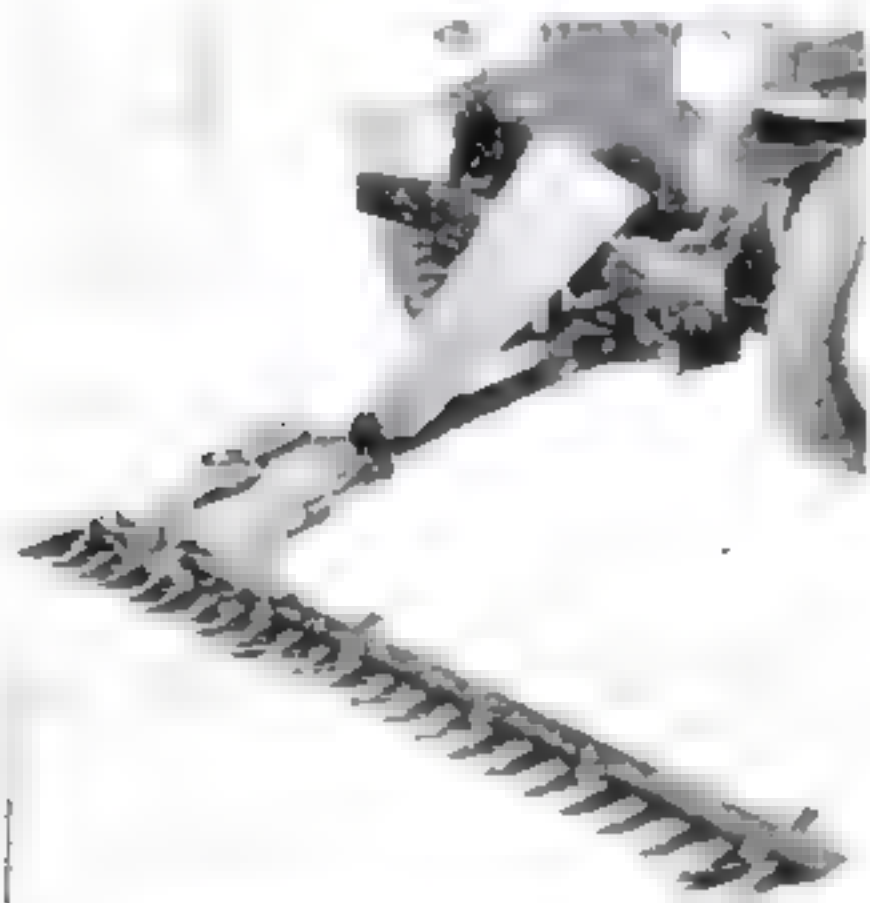
After welding, the block looked like this. The total time for the repair job was seven hours.

Badly Cracked Cylinder Block Saved by Welding

ALTHOUGH the cracked cylinder block above seemed a good candidate for the junk heap, a welding job made it as good as new. The job was done as a demonstration of welding at the Hobart Trade School, Troy, Ohio.

After thorough cleaning, the cracks were chipped to a $\frac{1}{8}$ " V, and all sides of the loose piece were beveled to form a V with the

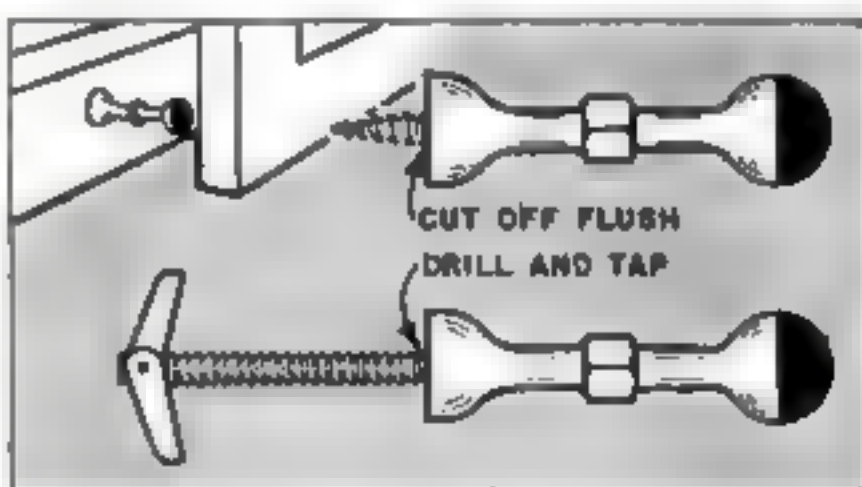
sides of the opening. Welds were made from the start of the cracks toward the open end, and beads were kept short, between $\frac{1}{2}$ " and $1\frac{1}{2}$ " long. Peening was started the instant the deposited metal lost color, and welding was not resumed until the bare hand could be placed on the weld. When welding was complete, the beads were ground to remove surplus metal.



Mowing Bar Attached in Front

DESIGNED for use with a Jeep \odot or four-wheel tractor, this grass cutting blade may be attached at the front of the vehicle.

Operated from the power takeoff, the cutter has a patented driving head that enables the operator to lock the 6' bar at any angle between horizontal and vertical without leaving his seat. The machine is a product of Turner of Indiana, Inc., Indianapolis.



Toggle Holds Loose Doorstop

If you have trouble as I did in keeping a screw-in doorstop in place, the idea illustrated above will solve the problem.

Cut off the screw flush with the metal base of the stop, and drill and tap for a small toggle bolt from which you have removed the head. Then pass the bolt and toggle through a hole in the baseboard behind the door and turn it tight.—A. BURRIS.

Blowout Patch Useful as Tray

A LARGE blowout patch makes a fine sorting tray for the workshop. It may be spread out for easy examination and selection of small parts, and then can be squeezed into a funnel shape for pouring the parts back into their containers.—R. J. PAYANT.



My Hobby Paid for Itself

By W. J. LaFleur

Monogram pins of carved applewood, turned out by semiproduction techniques, paid for this man's \$1,000 shop. Here's how he did it.



1. Make experimental sketches on a small pad until you have a pleasing design, and ink in with a stylus pen and green ink. This gives good visibility to guide you on the jigsaw.



2. Cement the pattern directly on the applewood, using rubber cement, and drill holes in internal waste to admit the saw blade. Use a .020" blade with about 13 teeth to the inch.



3. Saw the outline last and watch out for your fingertips. The saw foot should be set so the wood can be freely guided without any binding.



4. Sand off the pattern and smooth the front and back. A quick ride on first a 2/0 and then a 6/0 sanding belt will do the job speedily.



5. Drill the back for the pin and clasp. Make a gauge (right) with phono needles to get the proper spacing. A punch "signs" my work.

THIS is the story of my ten years' experience in earning money with my hobby—money that was in large part reinvested in my workshop. The fun and satisfaction that I gained remain as net profit that can never be lost; but the income has bought equipment to make my workshop better.

My product has been mainly one item—hand-carved applewood monograms of distinctive design. Two differences have set them apart from commercial competition: the individual design, which particularly appeals to women, and the pleasing qualities—the color and texture—of applewood. For equipment I use a jigsaw, belt sander, a few wood-carving chisels, and the two special tools shown on page 234. The total time required to make one pin is about one hour.

If you should be tempted to try a similar enterprise, let me first pass on a few pointers. First, do not plan to assemble stereotyped alphabet letters, which is the basic mistake of most monogram projects. You

can make individual designs just about as easily, and their individuality is the secret of their appeal. The carving operation would be about the same in either case, so scant time would be saved.

Don't count on lumber yards for your supply of applewood. Several years' supply can be had from any farmer who cuts down an old tree. He will usually be open to some dickering for one or two 4' logs. Take the logs to a saw mill and have them cut into rough planks about 2" thick. When you get them home, resaw the planks into blocks about 2' long and rip them into slats about 1/4" thick. They will dry quickly; some will warp but little wood will be lost.

A wide variety of other hand-carved jewelry ideas will suggest themselves to you once you have worked this fine wood. It will take and hold the most exquisite detail. It needs no stain, for clear dull lacquer will bring out its full color. It can be carved against or across the grain almost as readily



6. Carving is done with the work hand-held; it is turned too often for vise clamping. Here a V-gouge is used in a push stroke between letters.



7. A flat chisel shaves down one part so it will seem to pierce a neighboring letter. The right thumb on the work guides and limits the stroke.



8. To shape fillets and to round members, a skew knife is handy. Note that a V-cut serves to separate the letters A and E in this piece.



9. Rounding the separation can be done with the flat chisel. The right thumb is again used as a stop on the short, accurate push cuts.



10. The skew knife may also be drawn toward the thumb in the conventional whittling manner. Extremely keen tools are safer and easier to use.



11. Eight pins and the tools that carved them. Note how the individual letters in the monograms seem to interweave or pierce each other.



12. Sanding strips whirled by a small motor remove carving marks and smooth the piece.

as with it. It does not easily split or splinter, and is strong, light, and a joy to work.

If you have not had much practice at carving, take especial pains to develop the short push stroke shown in several photographs. Although it feels awkward at first, it's worth learning, since it gives extreme accuracy of control. Hold the chisel or gouge so that the side of its blade slides along the pad of your thumb, which should



13. A large hypodermic needle on the cement tube inserts a daub inside each mounting hole.

be firmly pressed against the wood to protect against slips. Anchoring the thumb against the work this way guides the cutting edge and limits the length of strokes.

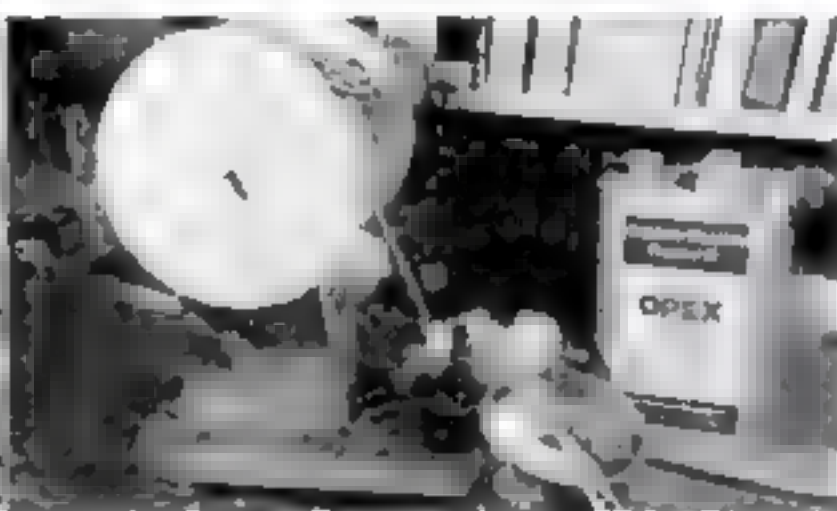
Clasp pins and safety catches can be purchased in quantity from jewelers' supply houses for a few cents apiece. I find that the best finish for the pins consists of two dip coats of dull furniture lacquer, with at least one hour between coats. Do not lacquer when the shop is damp or dusty.

For a professional touch, make or have made a marking punch that bears your own personal hallmark. (The writer's mark is a modified fleur-de-lis.) This signature on everything you make is a proper symbol of your pride of craftsmanship. **END**

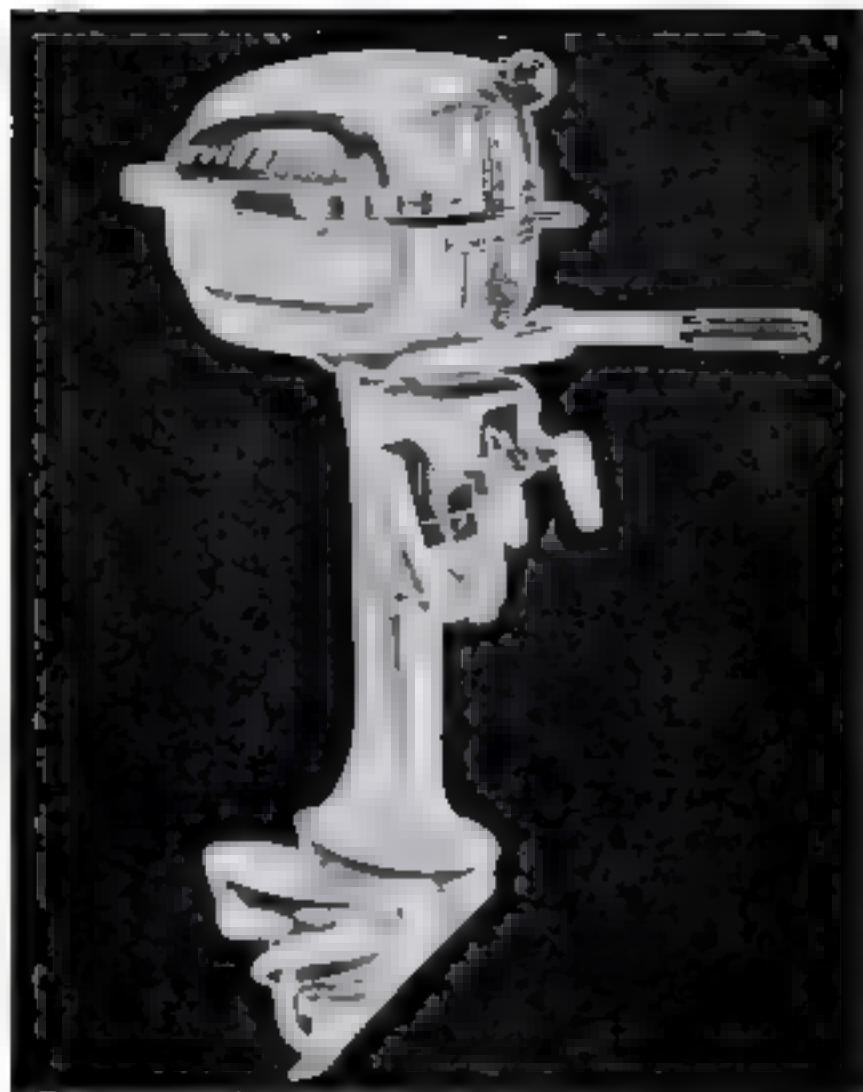
Sander and Lacquer Wheel Aid Production



TWO shopmade tools that have greatly facilitated the making of carved monograms are the sander and drying wheel pictured above. The former is a small series-wound motor mounted on a standard and wired through a 100-watt bulb to prevent excessive speed. A saw cut at the end of the arbor on its shaft takes four thicknesses of dentists' sanding strips. When whirled at a moderate speed, they penetrate every nook on the carving and leave a satin finish.

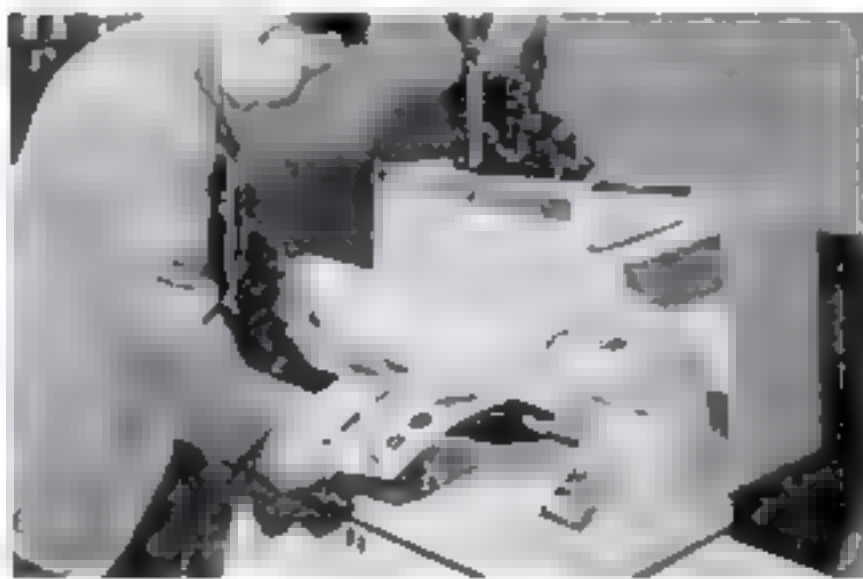


The drying wheel permits the pins to be dipped in lacquer without risk of runs or fat edges. It consists of two 9" pine disks on a cross shaft belted to a motor with a reduction gear. The disks turn at about 12 r.p.m. and are a fairly loose fit on the shaft so they can be stopped to permit inserting a pin without stopping the motor. A pin is dipped in lacquer and stuck on the wheel. After about 15 minutes of slow movement through the air, it will have dried with an even coat.



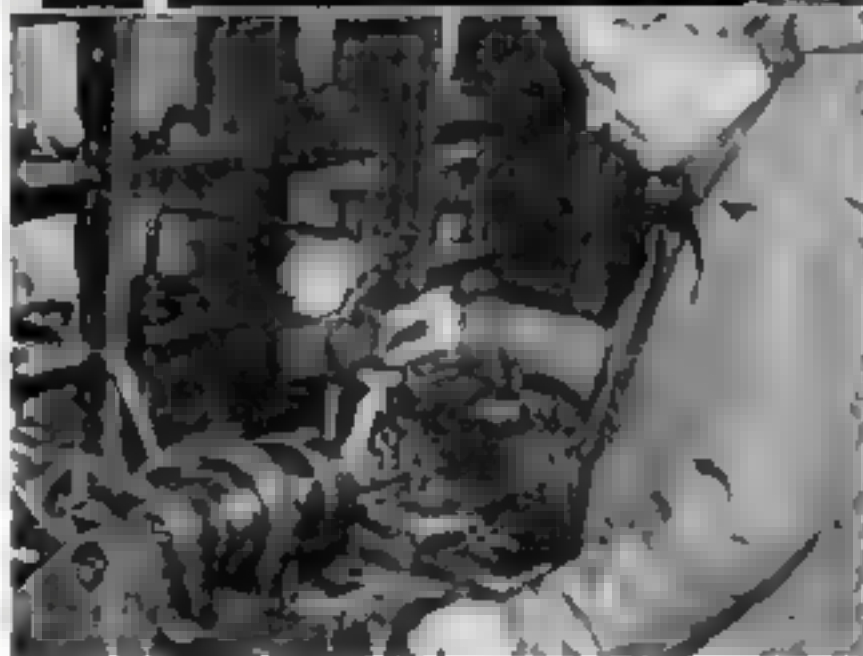
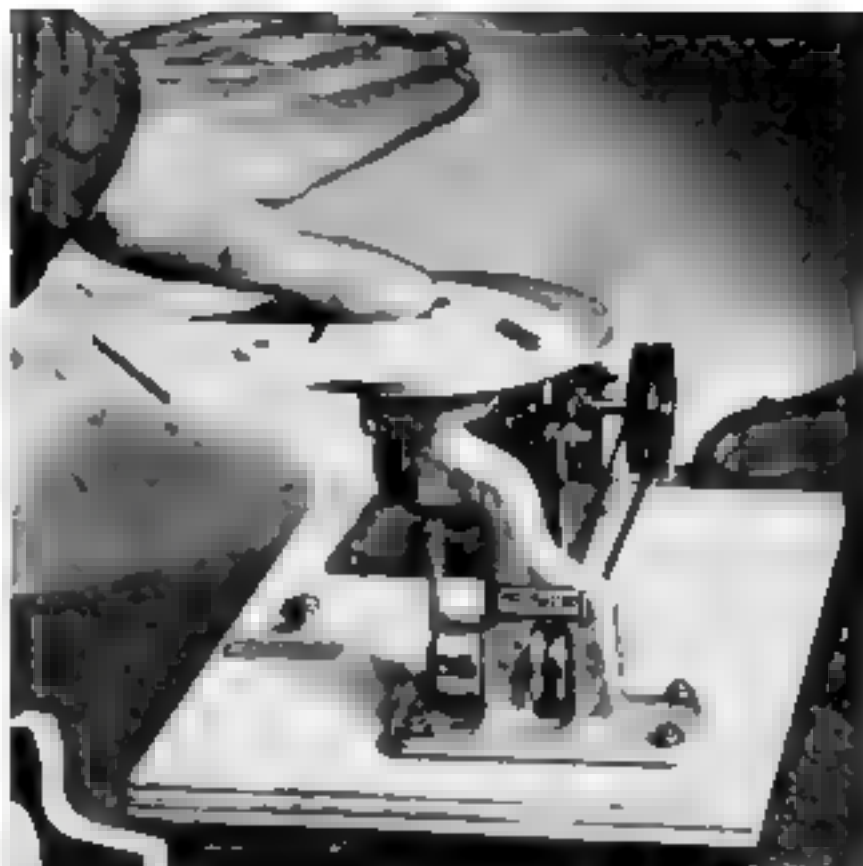
Outboard Has Fuel Gauge

IN THE new Evinrude "Sportwin" outboard motor, you don't have to open and close the fuel vent or shut-off, since the carburetor-adjustment lever performs these tasks automatically. Strikingly styled, the motor is of the twin-cylinder, alternate firing type, with improved carburetion. It is equipped with the Evinrude "weedless drive" lower housing and boasts a fuel gauge on the tank. Carrying grips are generously proportioned for easier handling.



Automatic Ironer Dries Photos

PHOTOGRAPHS may be dried in about a minute by running them through an automatic ironer eight or ten times. If alternate ends are used, the ironer roll will dry between prints. The procedure is particularly convenient for photographs that are too large for the ordinary drier or blotter.



New Jigsaw Protects Fingers

EVEN if you hold a thumb directly against the blade of a new miniature throatless jigsaw developed by Al Norquist, of Seattle, Wash., the stroke is so short that it's practically impossible to cut yourself. Inventor Norquist, shown in the lower photo drilling bearings for the saw, spent four years perfecting the safety feature.

Because there is no suspending arm, the cutting platen will accept material of greater surface area than conventional small jigsaws. The blade, extending 2" up through the 5" cutting platform, will cut soft woods such as balsa up to 2" in thickness and will handle $\frac{3}{8}$ " six-ply waterproof plywood with a 1/25-hp. motor.

Cutting angles are virtually unlimited because of the tiny cutting blade and the freedom of placement of material on the throatless cutting platform. Especially suited for modelmaking, the saw performs notching jobs and saves tedious whittling of fittings and parts. Replacement blades are available for 5 cents each.



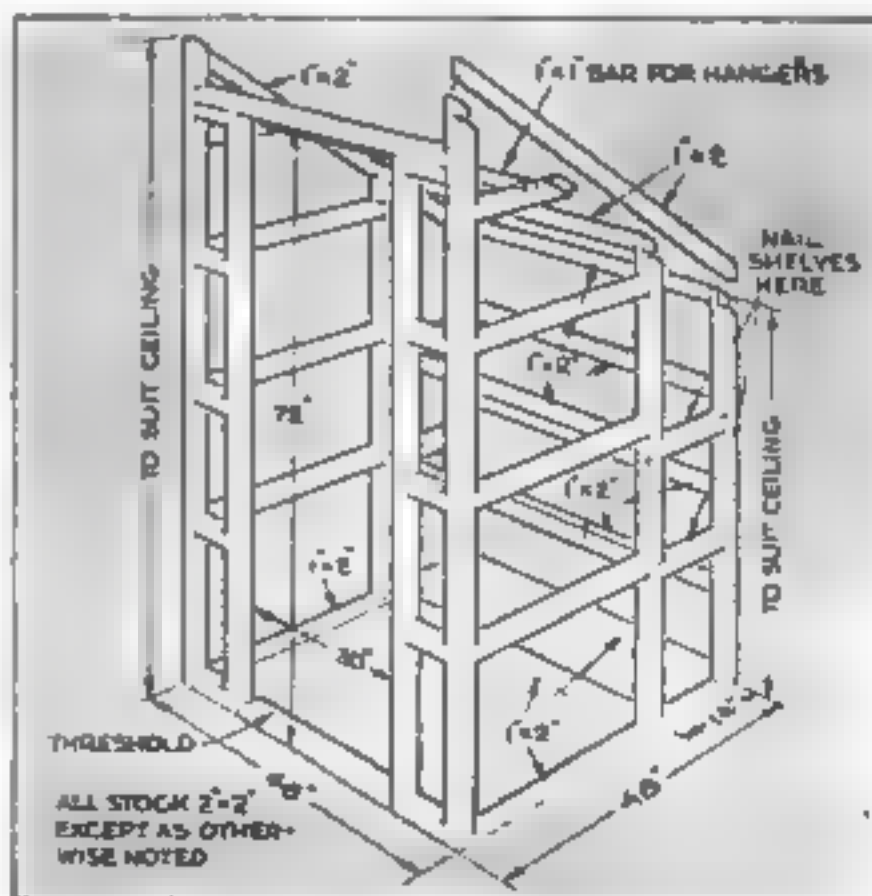
Closet Improves Attic

WITH house space at a premium, a finished attic deserves to be more than a mere storage place for trunks and old clothes. But no matter how well appointed, an attic bedroom is never really satisfactory until it has attained the dignity of having its own clothes closet. Here is a design that requires no fastening to wall or floor, and can therefore be moved up and down under the eaves to permit endless rearrangement of the furniture.

The front part of this closet—whose dimensions must be varied to suit the particular requirements of your attic—has enough height and depth to be really serviceable as a clothes closet. The normally wasted back part is made useful with storage shelves that can be reached from the side. Shelves are wide enough to hold duffel bags, small grips, and the like.

Construction details for the frame are suggested in the drawing. Locate the clothes pole or a 1" by 1" hanger bar approximately in the center of the closet space. Rear storage shelves are nailed to the 2" by 2" crosspieces as indicated. Standard threshold stock can be used across the door opening, or the piece may be shaped from a suitable length of 1" by 3" board butted against the uprights.

Side panels should be made of wood that is light in weight but also strong enough to add rigidity to the frame. Cedar paneling was used in the unit shown; plywood from $\frac{1}{4}$ " to $\frac{3}{8}$ " in thickness would also serve. No top or back is needed since the closet is made to fit snugly against the wall and roof. Doors may be added to front and rear sections, or either or both can be left open as shown in the photos.—EDWARD R. LUCAS.



Ivy Holder Built Like Old Lantern

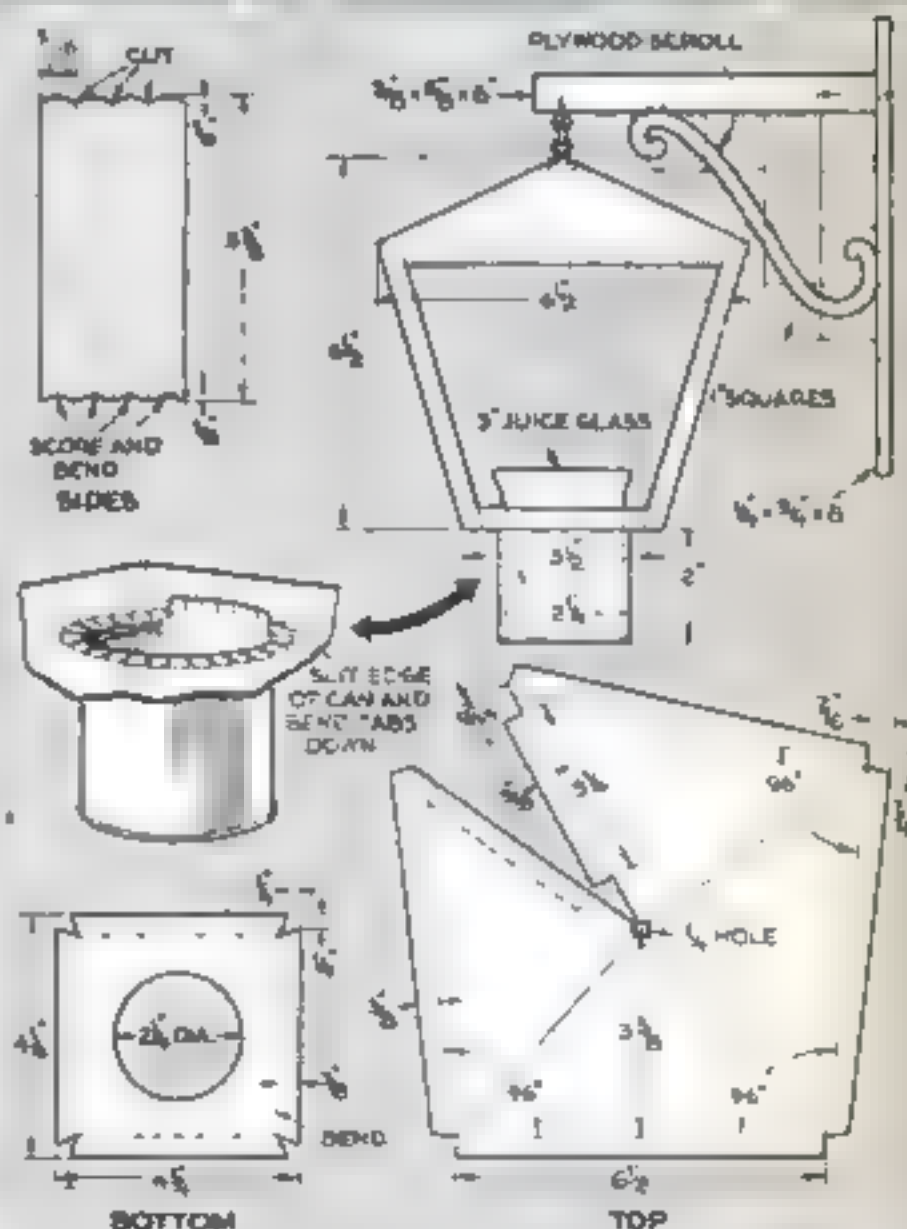
DESIGNED from an antique lantern, this ivy holder was cut and bent to shape from scraps of tin plate. For the bottom, lay out a $4\frac{1}{4}"$ square and inside this another measuring $3\frac{1}{2}"$, leaving a $\frac{1}{2}"$ margin. Measure back $\frac{1}{4}"$ each way from all corners of the outer square, connect with the corners of the inside square, and score the inside square with a metal scriber. Scribe a $2\frac{1}{4}"$ circle at the center.

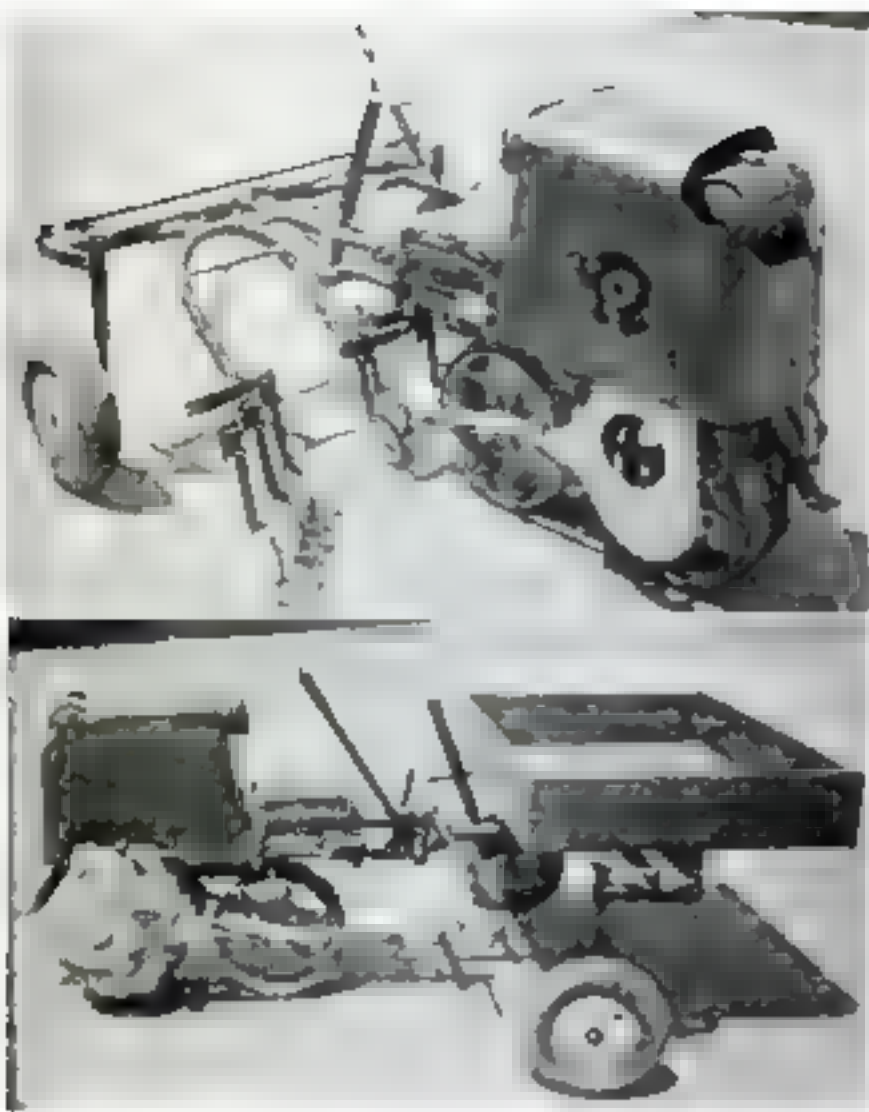
Then cut out the bottom—the circle, the outer square, and the V-shaped pieces at each corner—and bend up the edges along the inner lines. For the ivy-pot well, cut and install a tin can as indicated, anchoring the retaining tabs with solder.

To make corner uprights, mark off adjoining strips $5/16"$ wide and $5\frac{1}{2}"$ long on a sheet of tin plate, lay out angled ends as seen in the drawing, score the corner lines, and cut the strips apart. For ease in bending, clamp one side of each leg between two pieces of wood or place it in the jaws of a large woodworking vise.

In laying out the top, begin by marking off a $6\frac{1}{2}"$ line. From its center, erect a perpendicular, measure up $3\frac{1}{2}"$, indent with a center punch, and scribe bending lines between this point and the ends of the base. With a protractor now lay out lines from either end of the base at an angle of 98 deg., measure off $6\frac{1}{2}"$ on each, connect with the center point, and establish the fourth side in the same way. After marking off a $\frac{1}{2}"$ margin on each side, mark one corner by measuring back $7/16"$ as seen in the drawing, and then use a bevel gauge to lay out the others. Before cutting out, drill a $\frac{1}{8}"$ hole at the center. Assemble with rivets or small bolts and nuts.

The bracket consists of three wood members, a $\frac{1}{2}"$ by $\frac{1}{2}"$ by $8"$ back with a $\frac{1}{2}"$ by $\frac{1}{2}"$ by $8"$ arm supported by a plywood scroll. Form a narrow U from stiff wire, force the legs through the hole in the lantern top, cross them inside, and bend up against the top. Wire this loop to a screw eye in the crane, and the job is complete. Paint the lantern as desired.—JOHN J. GALLIVAN.





Garden Tractor Uses Crawler

THE economy of small-tractor operation is combined with the efficiency and power advantage of crawler trucks in this new rear-engine tractor being marketed by King Equipment Company, Skokie, Ill. Traction is obtained through a 6" treaded rubber track which provides 120 sq. in. of ground contact. A 4-hp. single-cylinder engine, automatic clutch, and transmission give two speeds forward and one reverse. Detachable tools include a moldboard plow, two-row cultivator and planter, sickle bar mower, spike-tooth harrow, and carrying box. The upper photo shows the cultivator attachment, the lower one the two-wheeled box. With tools mounted forward and the engine behind, the operator, who rides the tractor, has a clear view of the work ahead.

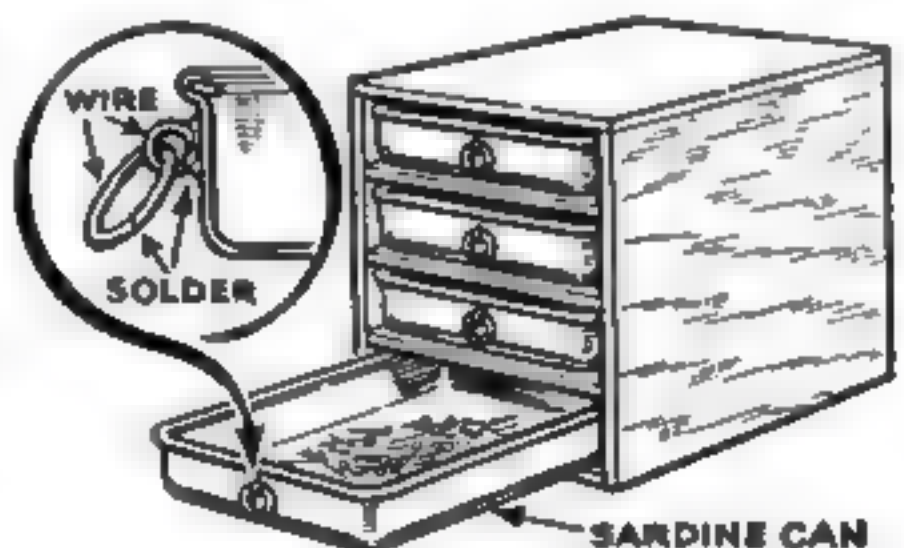
Mending Electrical Porcelain

A FRACTURE in the ceramic base on which an electric heating element is wound can be repaired with water glass (sodium silicate), which will withstand high temperatures. Dilute one part of water glass with four parts of water and brush or drain the liquid onto both faces to be mended. One or two preliminary coats add strength. Tie or clamp the edges and allow at least 24 hours for drying. Before putting the heater into service, turn it on at low heat to warm the mended spot.—H. D. KELLOGG.



Model-Plane Noise Is Muffled

WHEN his fellow townsmen objected to the noise of his young son's model airplane, Marty Johannes, of Burbank, Calif., designed the muffler for model gas engines he is shown holding above. Made of aluminum, the 10" long muffler weighs but 3½ oz. Beyond 100', no noise can be heard from models equipped with the device; at closer range engine roar is said to be sharply reduced.



Sardine Cans Hold Small Parts

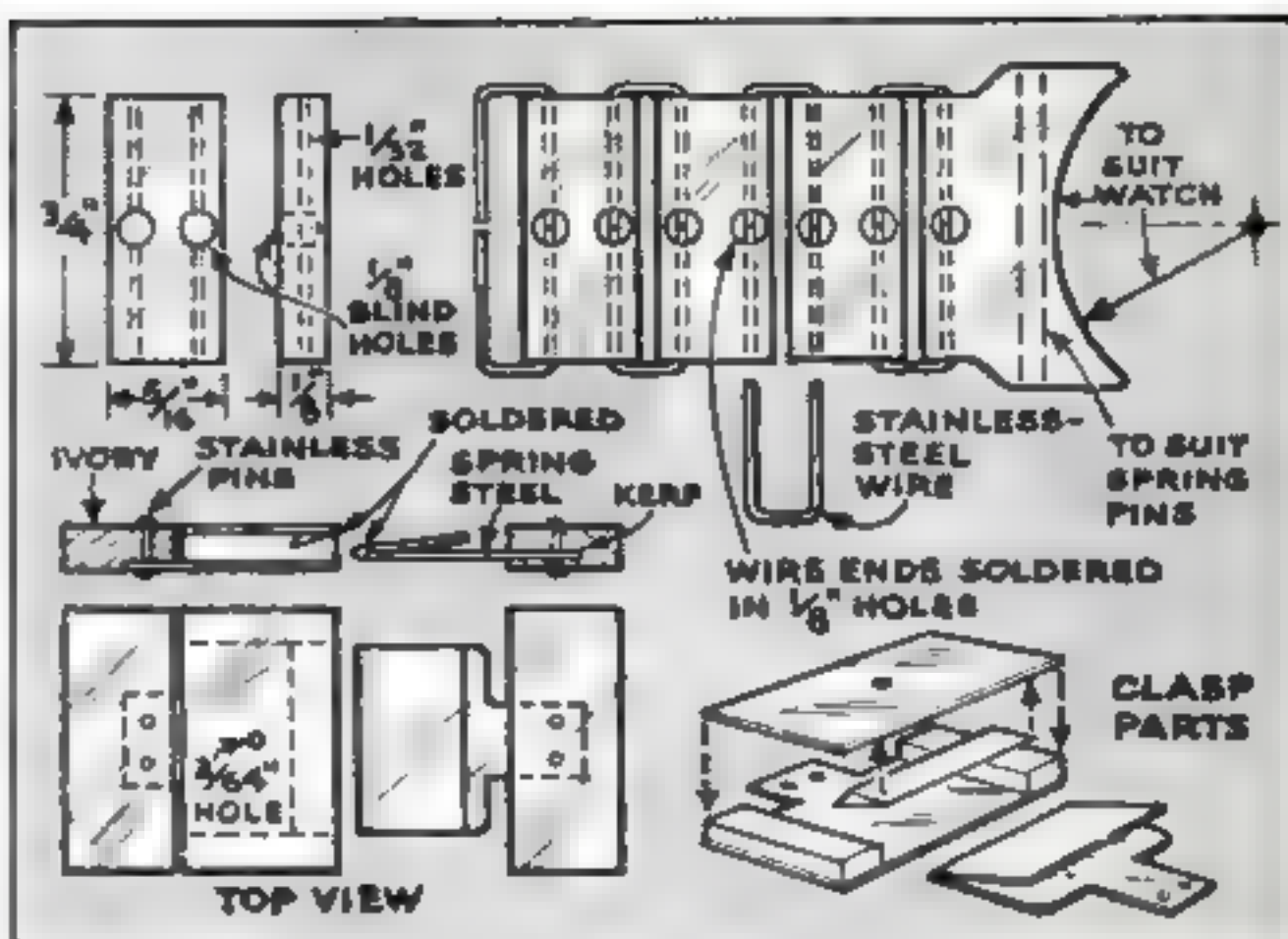
STORAGE drawers for nuts, washers, and other small hardware can be made from a few sardine cans on which the sharp edges have been turned down. Wire loops are soldered to the face of the cans for drawer pulls. Plywood, composition board, or any similar material can be used to assemble the shelves and outer walls, and of course you can group any number in the most suitable arrangement.—CLIFFORD LAWRENCE.

Watch Bracelet Made in Ivory

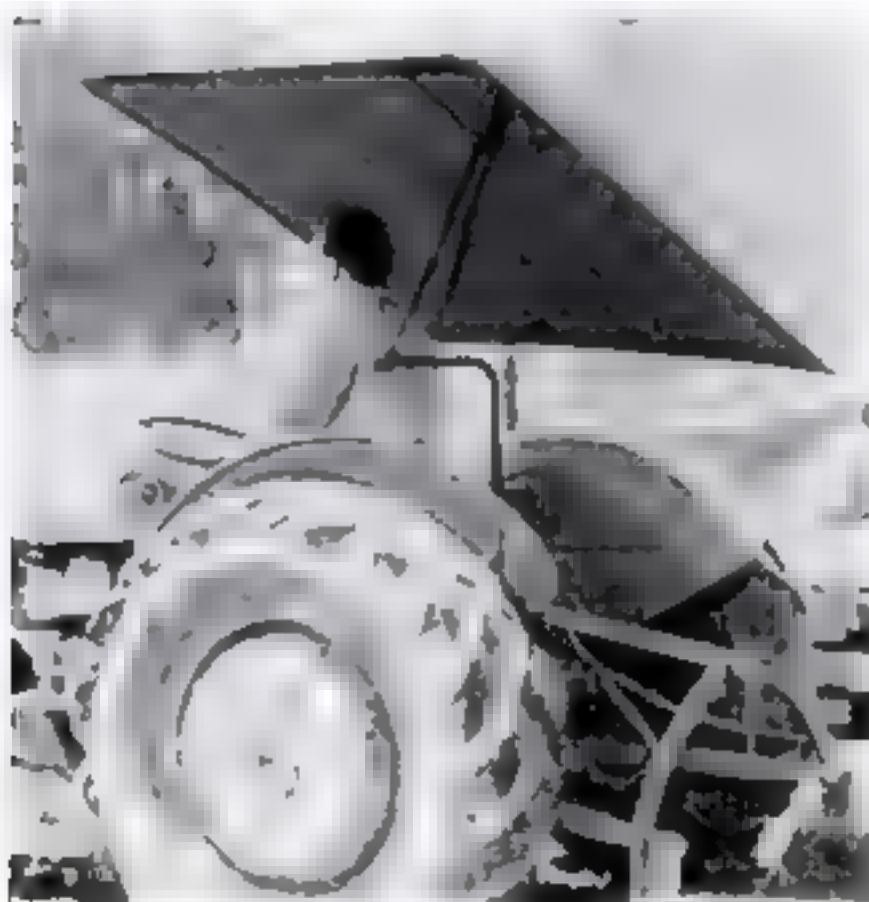
HAVING acquired some walrus tusks during my service sojourn with the Eskimos, I made them into a wrist-watch bracelet. Ivory isn't common, to be sure, but the construction can be adapted to plastic or fine-grained hardwood.

Link blocks are cut $\frac{1}{8}$ " by $\frac{5}{16}$ " by $\frac{3}{8}$ ", and then filed, polished, and drilled as shown. They are connected by U-shaped pieces of stainless-steel wire soldered together in blind holes on the inside of each block.

As shown in the details, the spring-steel clasp parts are soldered together. Both



socket and tongue are riveted to the end blocks. To open the clasp the catch is depressed by inserting a pencil or other point through the $\frac{3}{64}$ " hole in the cover piece of the socket.—EDWARD A. ZAFIAN.



Umbrella Shades Tractor Seat

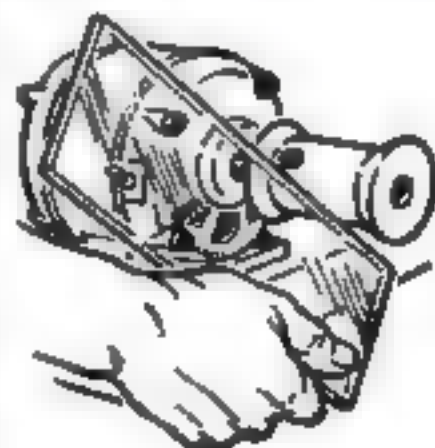
NEITHER sun nor rain can get at the operator of a tractor equipped with one of these adjustable umbrellas. It can be raised, turned, or tilted to come between the sun and the operator as the tractor moves across the field or the sun moves across the sky. A 54" canvas shade is attached to the all-steel frame. The Snow Corporation, Omaha, Nebr., is the manufacturer of this farmer's friend.

Opening Joints in Soil Pipes

IN REMODELING or repairing drainage facilities, it is frequently necessary to insert a Y or remove a section of cast-iron pipe. One practical method of opening a run of soil pipe is to cut through it with a cold chisel just above a convenient joint. Loosen the remaining joints by twisting the pipe. If heat must be applied, use a blowtorch. To remove a long stretch, it is easiest to use the blowtorch on every second joint, the intermediate joints being melted on an open fire.—J. MODROCH.

Wooden Spool Grinds Plastics

A LIGHT-DUTY grinding and smoothing wheel for plastics can be made from an ordinary wooden spool. Mount it tightly on a motor shaft, polishing head, or lathe, enlarging the hole if necessary. A countersunk machine screw driven into a drilled hole acts as a setscrew. Used without abrasive paper, the spool will smooth or round edges.—FRANK SHORE.



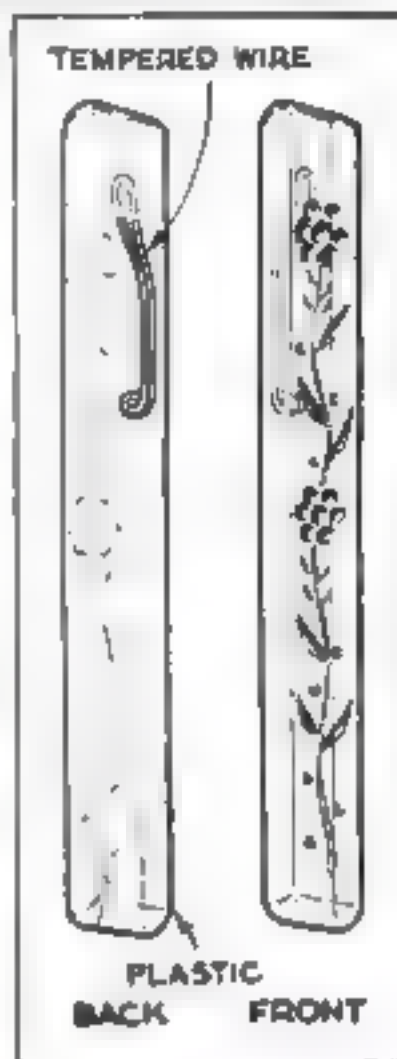


Framing Square Is Set to Pitch

ONCE this new tool is set to the pitch of a roof, it automatically gives the correct marking angles for jack rafters, hip and valley rafters, and similar framing parts. A degree scale is also provided to lay out work for power-saw cuts. Made by Lloyd Crowley, of Salem, Ore., it costs about \$11. When folded, it measures only 2" by 12".

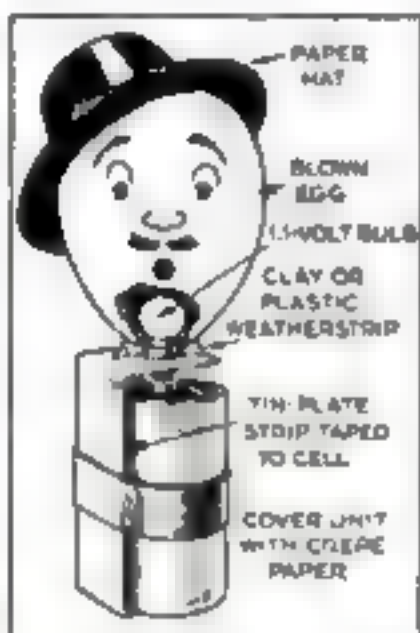
Wire Clip Melted into Plastic

ALTHOUGH cement is commonly used to attach clasps and pocket clips to plastic jewelry and lapel pins, it often gives an insecure bond. It's better to use the heat-sensitive quality of plastic to anchor the fastening. Heat the end of the clasp with a soldering iron, force it into place, and let it stay without movement until the plastic rehardens. Don't heat a tempered steel clip in a flame since it might lose its springiness if it became overheated.—M. B. HOBS.

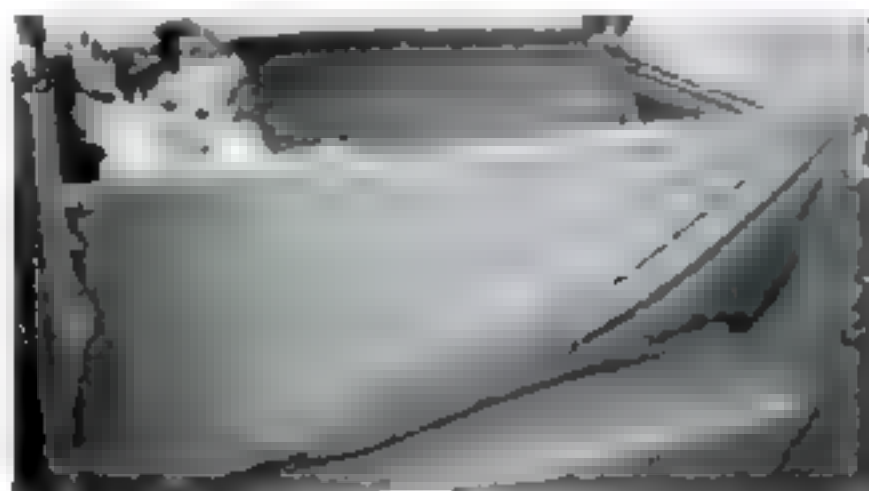


Egg Favor Is Lighted by Bulb

WITH a flashlight bulb inside a blown egg, this Easter table favor makes an unusual party decoration. Break away just enough of the shell to clear the bulb, which is turned into a snug hole in a C-shaped tin-plate strip. Modelling clay or weather-stripping seals the juncture.



Draw the face with India ink or water colors, and add crepe-paper clothing. Turn it off or on by bending the lower contact.

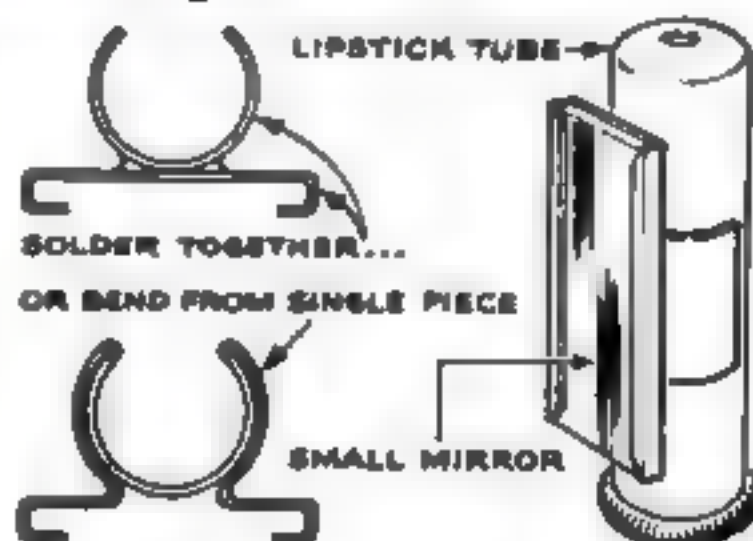


Car Back Seat Forms Play Pen

DESIGNED for easy installation between the back windows of any sedan, a new accessory made by the Aller Manufacturing Company, of Chicago, converts a rear auto seat into a combined play pen and baby bed. Its retail price is about \$8.

Small Mirror Is Clipped Around Lipstick Case

THE weaker sex, always partial to mirrors, seems particularly fond of this one, which consists of a tiny rectangular mirror in a brass clip shaped to fit a lipstick. Being detachable, it can be quickly transferred to a new lipstick when the old one is used up. Make it of thin, springy brass, either soldering the semicircular clip to the mirror frame or bending frame and clip from a single piece. Use abrasive cloth to soften all sharp edges, buff to a high luster, and lacquer. Then slide the mirror in place.—T. P. ILARI.



Improve your darkroom technic

with these inexpensive KODAK AIDS...

KODAK WASHING ASSEMBLY . . . converts your home sink into a circulating washer . . . washes negatives and prints. Fresh water enters sink from faucet through a hose, which can be affixed to side of sink by means of a vacuum cup. This insures desired circulation and thorough washing. Water drains out through adjustable stopper over sink drain. Price, \$2.25.



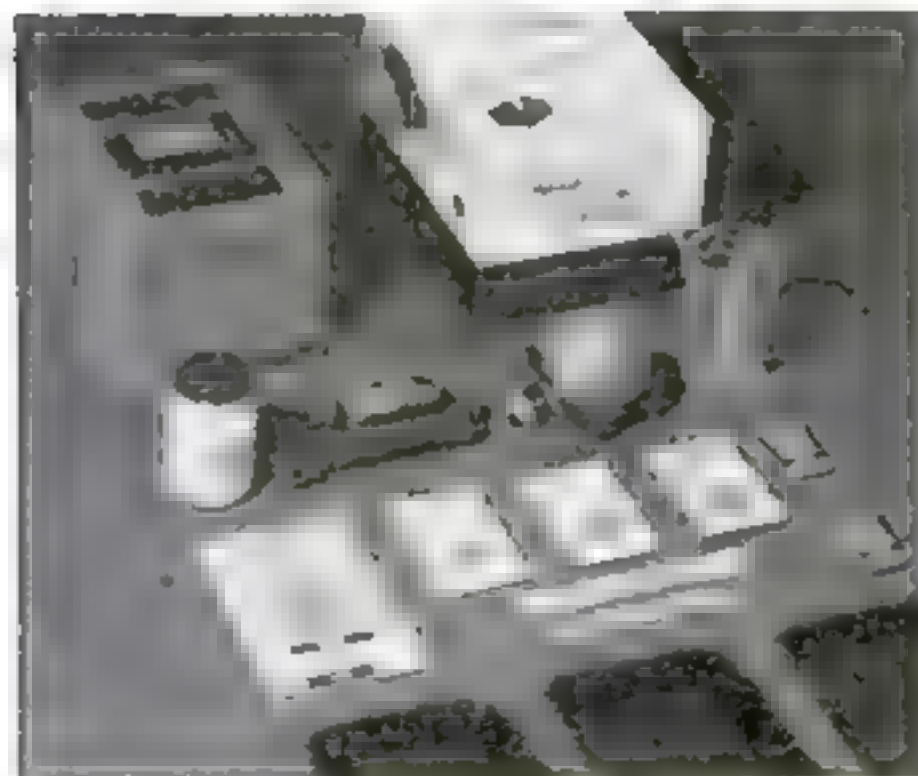
KODAK COMBINATION FUNNEL . . . helps you pour solutions without wasteful spilling. Easy to clean. Made in two sections which can be used singly or in combination, providing 3 sizes of funnels. Large section has maximum diameter of 5 inches, and 2-inch spout. Small section fits over spout of large section and terminates in 1/2-inch spout. Price, 85 cents.



KODAK DARKROOM THERMOMETER . . . provides accurate temperature readings from 0° to 120° Fahrenheit in 2° calibrations . . . is marked with a big star at 88°, the safe temperature for most of your darkroom solutions. Price, 45 cents.



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KODAK ABC PHOTO-LAB OUTFIT . . . contains everything you need for easy developing and printing—metal printing box with 4 x 5 1/2-inch negative area, darkroom lamp, trays, chemicals, stirring rod, graduate, darkroom thermometer, printing paper, film clips, and an illustrated book of complete instructions. Price, \$8.50 plus tax. EASTMAN KODAK CO., ROCHESTER 4, N. Y.

"Kodak" is a trade mark

Kodak

His hobby is gunsmithing. He uses Nicholson files.



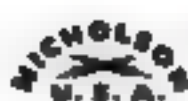
**YOU CAN TELL
A CRAFTSMAN
BY THE TOOLS HE USES**

ONE thing you'll notice about a real craftsman is the kind of tools he uses. They don't need to be fancy or intricate, but you can be sure they're top quality—the very finest made.

Files, for example, are selected with special care. For filing is an art. And the right file in hands that know how to give it "just the right touch" is often the deciding factor between a masterpiece and a failure. This is why you'll find a wide assortment of Nicholson or Black Diamond brand files on the work-benches of most artisans. Their superior performance far outweighs their small extra cost.

Try a few and see if they don't do better work, cut faster, last longer, cost less in the long run. They're easy to get—good hardware stores carry a practical variety.

Write for free book, "File Philosophy." It tells how to choose, use and take care of files.



**NICHOLSON FILE CO., 18 Adams St.,
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(In Canada, Port Hope, Ont.)**

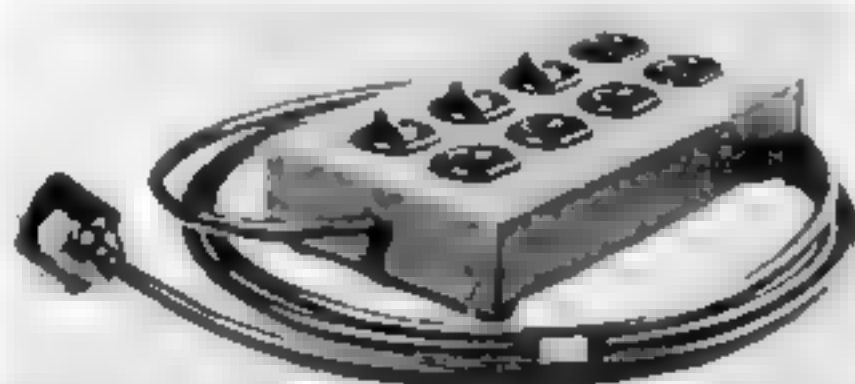


**NICHOLSON
FILES** FOR EVERY PURPOSE



Driller Costs Little

This low-cost, easy-to-operate well driller, which requires attention only at intervals of several hours, works either outdoors or indoors. Operating at approximately 38 strokes a minute, the drill progresses downward while automatically feeding out 60 feet of cable. A product of Consolidated Industries, of Wallingford, Conn., it measures six feet square at the base, eight feet tall, and weighs 450 lb. Power may be supplied by a $\frac{1}{2}$ - or $\frac{3}{4}$ -hp. electric motor, or a small gasoline engine.



One Plug—Five Outlets

Just plug in this unit and you have several electrical connections from a single outlet. Heavy bus-bar wiring is used internally in the device, which has separate switches for three of the connections. Produced by Ewart, Healy and Koch, Inc., of Boston, Mass., it is $4\frac{1}{2}$ by 8 by $1\frac{1}{4}$ inches. Protection against shorts or overloads is afforded by a fused attachment plug containing two 15-amp. cartridge fuses.

Dependable

CHAMPION

America's Favorite Spark Plug



Your choice of Champion Spark Plugs for your car is made easy and sure by the fact that Champion has consistently been America's favorite spark plug, and is backed by performance records unequalled by any other. Champion Spark Plug Company, Toledo 1, Ohio.

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MARCH 1948 243

**It talks with
planes around
the world**



You're looking at a "rotary beam parasitic array antenna." What it does is big as its name. By high-frequency continuous-wave transmission, the Air Force can talk to planes anywhere on earth.

Here's an instance. Recently, 8 Superforts departed Tokyo on a non-stop flight to the nation's capital. Air Force—in Washington—made contact a few minutes after their departure, stayed in communication with its winged offspring right to their destination.

This wizard antenna and its witch-wife—a supersensitive receiving antenna—are a joint accomplishment of Signal Corps and Air Force. It is typical of technical advances that are the daily business of our Armed Services.

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a new Ferret Set

by **Snap-on**

A new design... strong... adaptable...
they squeeze into close places easily

(All units $\frac{3}{8}$ " Square Drive)
 11 — Single Brouched Sockets
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 from $\frac{1}{8}$ " to $\frac{1}{2}$ "
 1 — Speeder Wrench 1 — 8" Ratchet
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 1 — Universal Joint
 3", 6", and 12" Extensions
 — Complete in a metal box,
 19 $\frac{1}{2}$ " x 5 $\frac{1}{4}$ " x 1 $\frac{1}{8}$ " — specially
 designed for this set.
 Rich, red enamel finish.

Yes, a new Ferret Set . . . new in design . . . way over
 par in performance — and they're twice as strong as
 you would expect such slim, slender handles and thin-
 walled sockets to be.

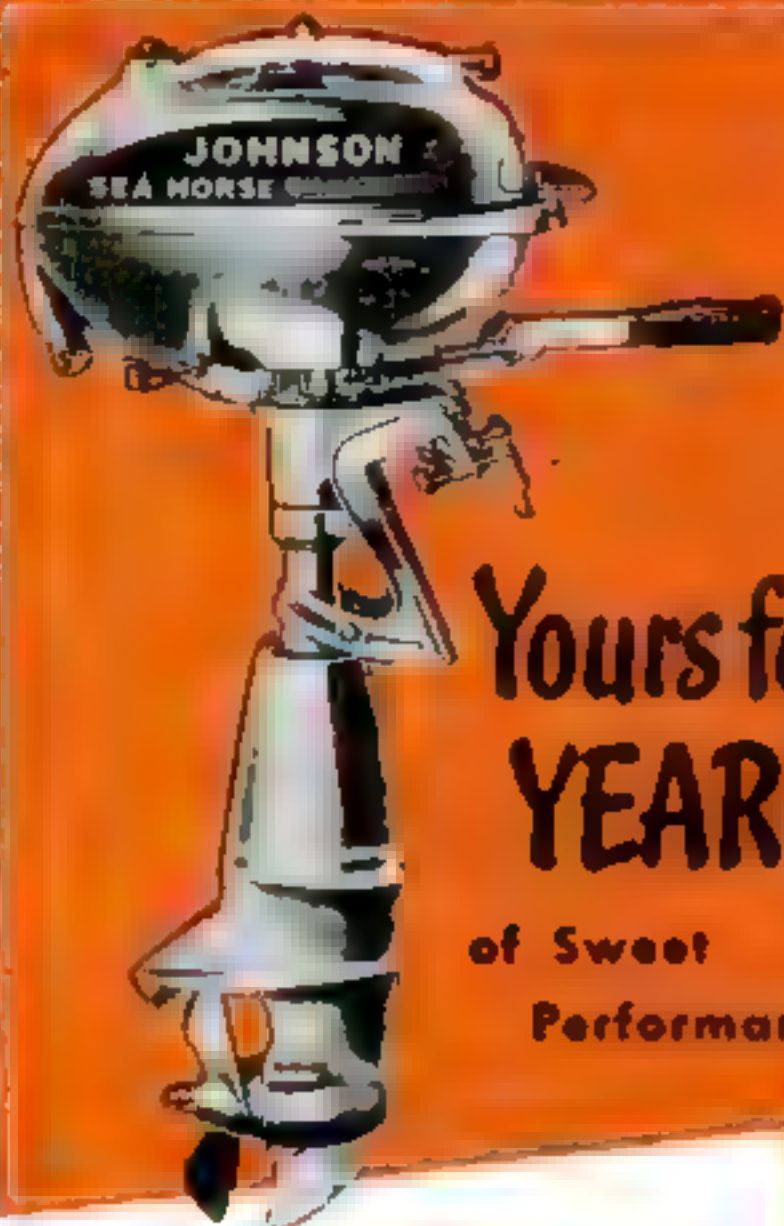
They squeeze into tight places and get those hard-
 to-reach nuts and bolts that defy the ordinary type
 wrench. Newly designed by Snap-on engineers, they
 make quick easy work on many of the tough jobs on
 modern motors and engines.

Be sure to ask your "Snap-on" man to show
 this set the next time he calls.

SNAP-ON TOOLS CORPORATION

8060-C 28th Avenue • Kenosha, Wisconsin
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YEARS**

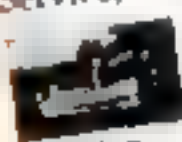
**of Sweet
Performance**

When you look for quality features in an outboard motor, look for them in the line where they were originated, developed, and perfected

These are **JOHNSON** Developments

- Perfected Alternate Thruing
- Dual Carburetion
- Reverse
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- Rotary Valve
- Ready-Pull Starter
- Die Cast Cylinder Block
- Anti-Cavitation Plate
- and many others

Also yours, in a Johnson, are Nation-Wide Service, High Trade-in Value, Long Life.



FREE Handy Chart

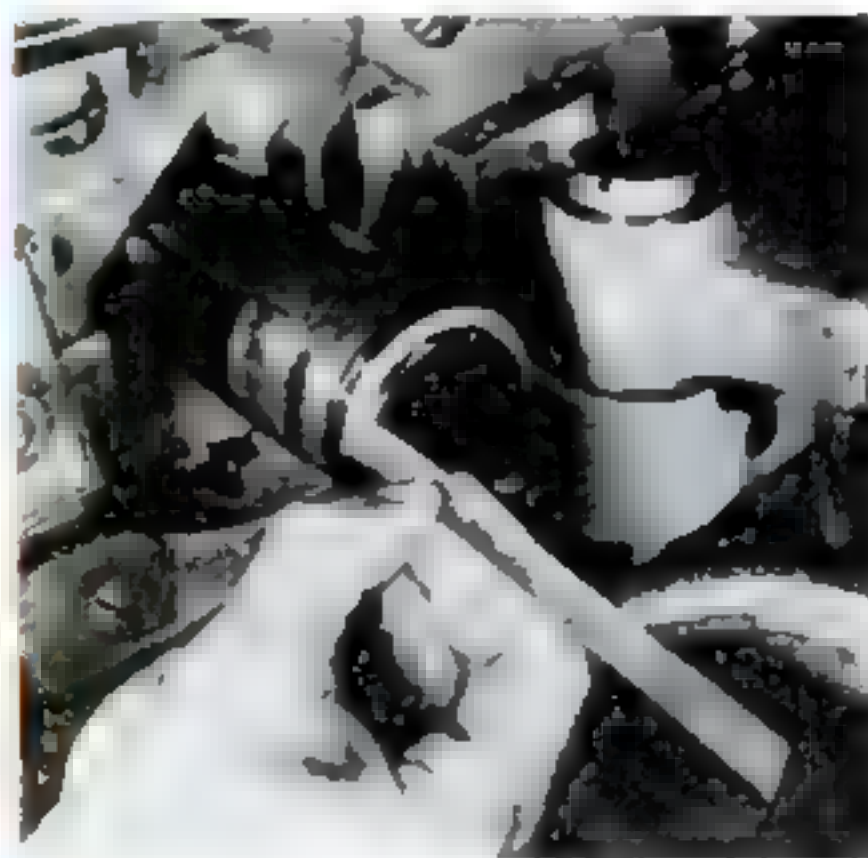
Write for the new 1948 Sea-Horse Handy Chart illustrates charts the 5 great Johnsons for 48. See your Johnson Dealer about delivery. Look for his name under "Outboard Motors" in your classified phone book. Johnson Motors, 500 Pershing Rd., Waukegan, Ill. Johnson Motors of Canada, Peterboro, Canada

JOHNSON
SEA-HORSES
for DEPENDability



Battery Choice Offered

This small hearing aid contains its own tiny batteries, but for economy has a connection for plugging in the larger "A" battery shown at left above. The instrument, recently introduced by Sonotone, is made of plastic and finished in rhodium. It measures 4½ by 2½ inches and weighs just over seven ounces, including batteries.



Lining Protects Pipe

PIPE shown above is lined with a plastic material—Saran—that makes it resistant to chemicals, oils, and solvents. Designed to carry corrosive liquids, especially acids, the new pipe and fittings were developed by the Dow Chemical Company. Workman in photo above is measuring projection of Saran lining to insure proper sealing at a joint.

NEW**NEW****NEW**

AUTO-LITE

Resistor

SPARK PLUG

Here's what it is

The many benefits which can be obtained through a wider than standard spark gap setting are well known to the automotive industry. Up to this time the rate of spark gap increase due to electrode erosion has been such that the desired wide setting has not been generally used. Auto-Lite, working with leading car and truck manufacturers, has Ignition Engineered a built-in 10,000 Ohm Resistor which reduces electrode erosion so that Auto-Lite Spark Plugs can now be given this wider gap setting desirable for improved operation and economy.

Here's what it does

PROMOTES SMOOTHER IDLING, because the wider spark gaps help eliminate occasional missing.

REDUCES MISFIRING due to lean spots in carburetion.

ASSISTS IN BURNING OF LEANER MIXTURES for improved engine economy at idle and throughout the speed range.

REDUCES RING AND CYLINDER WEAR when lubrication is washed away by gasoline not burned as a result of occasional misses.

INCREASES ELECTRODE LIFE up to 200% and more.

SUPPRESSES SPARK PLUG INTERFERENCE with radio, radio-telephone, radar and television reception.*

Advantages So Significant They Are Expected To Affect The Entire Industry

A complete line of Auto-Lite Resistor Spark Plugs with the built-in Resistor will soon be available for original equipment and replacement on popular makes of cars, trucks and tractors. The regular line of Ignition engineered Auto-Lite Spark Plugs, which has won such an enviable reputation for dependability of performance, will continue to be manufactured. Ask your favorite dealer.

THE ELECTRIC AUTO-LITE COMPANY

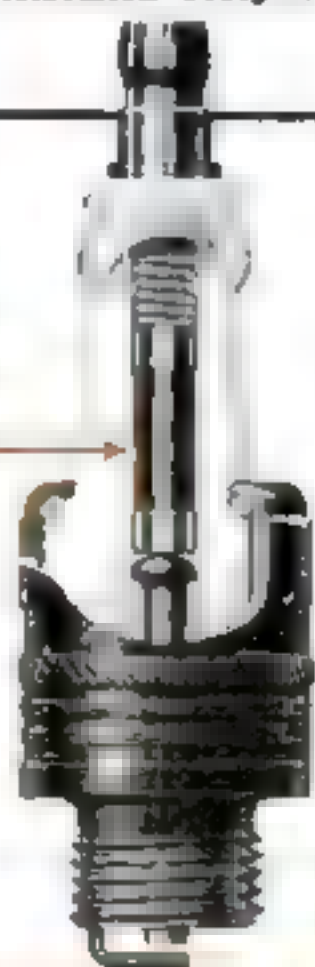
Toronto 1, Ontario

Toledo 1, Ohio

NEW

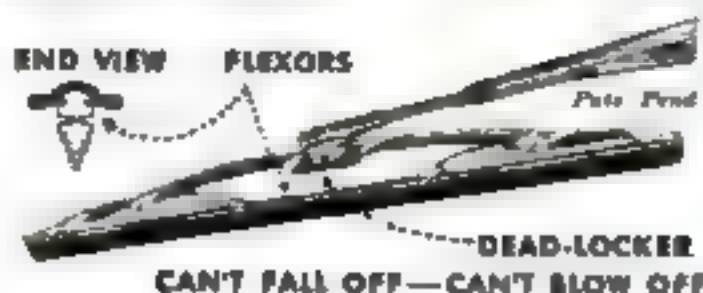
BUILT-IN RESISTOR

Auto-Lite Ignition Engineers, working with leading automotive manufacturers, have developed the new Auto-Lite Resistor Spark Plug with this built-in resistor. As a result, improved operation and economy will be possible for the owners of cars, trucks and tractors everywhere.



*Within 35 mc. from 540 kc. to 150 mc. at 50 ft.

TRY THIS AMAZING NEW
ANCO® CLEAR-FLEX
Trade Mark
WINDSHIELD WIPER BLADE



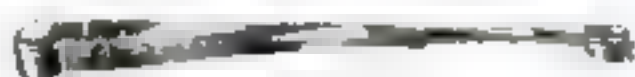
FLEXES TO CLEAR THE LOW SPOTS

Know CLEAR-FLEX . . . the first Wiper Blade to conform fully to all windshield surface irregularities. Even wipes uniformly all types of curved windshields. Keeps clear those annoying hard-to-reach low spots common to all FLAT windshield glass. Clears quickly blinding road muck . . . slapped against your windshield from sloppy pavements by passing cars. CLEAR-FLEX already has engineering approval for original equipment on coming models of high-grade cars.

THRILL WITH CLEAR-FLEX AS OUR "GUEST"

Deposit with your dealer only the regular retail price. Use CLEAR-FLEX through the next storm. Then IF you are willing, dealer is authorized to remove CLEAR-FLEX and refund all your money.

ANCO DEAD-LOCKER®



WIPER ARM

ANCO Arm fits quickly any wiper shaft. Suits any good wiper motor. Holds Blade true . . . at correct pressure. If not now on your car, ask serviceman to install a PAIR quickly for you. More than 250,000 good gas stations and service stores sell ANCO BETTER Blades and Arms.

Made by the makers of long-famous ANCO RAIN MASTER® Blades and Arms . . . original equipment for years on DeLuxe models of high-grade cars. Your dealer knows ANCO.

**Get yours next time you buy gas.
 May save you a costly smashup.**

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THE ANDERSON COMPANY
 Established 1916
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**Proved by Big Truck Fleets—
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 Ends Auto Radiator
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It started in radiator hose. But Butler De-Scaler's scientific and efficient dissolves scale and rust throughout cooling system—keeps water circulating, mud and sludge free.



With rust up, boiler over, pump and thermostat troubles due to scale. Guaranteed for 1 year or 25,000 miles. Does not interfere with anti-freeze or prop. tank. A gallon of De-Scaler will clean 250 sq. ft. of scale. Fair Trade List Price. Butler Engineering Co., 2024 Roosevelt Street, New Orleans 12, La.

BUTLER De-Scaler

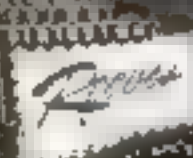
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 GOOD LOOKS FOR PLAY**



Reeves Army Twill is a double duty fabric. It's highly resistant to wear and tear, and its wide variety of colors are fast to color. It can stand up to the toughest work and still come up fresh and new. It's better looking and longer wearing than any other fabric. Reeves Army Twill. *Keep it looking like new.*

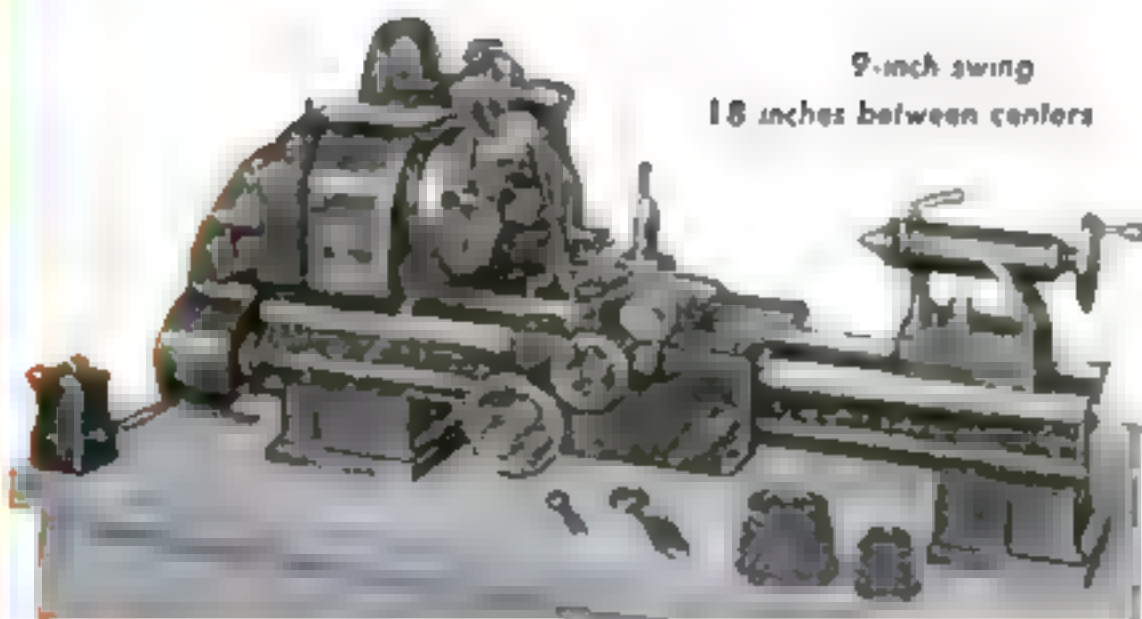
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**SPEED, ACCURACY
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9-inch swing
18 inches between centers

**Make This 9-Inch
Logan Lathe a
Stand-Out at \$159.50**

Here in compact, 9-inch size are the speed, accuracy and precise, rugged construction that make the larger Logan Lathes outstanding industrial performers. High speed, ball bearing spindle stays accurate. Self lubricating bronze bearings protect vital points. Bed ways precision ground to within .0005" of parallelism. See it at your Logan Lathe dealer's, or write for information.

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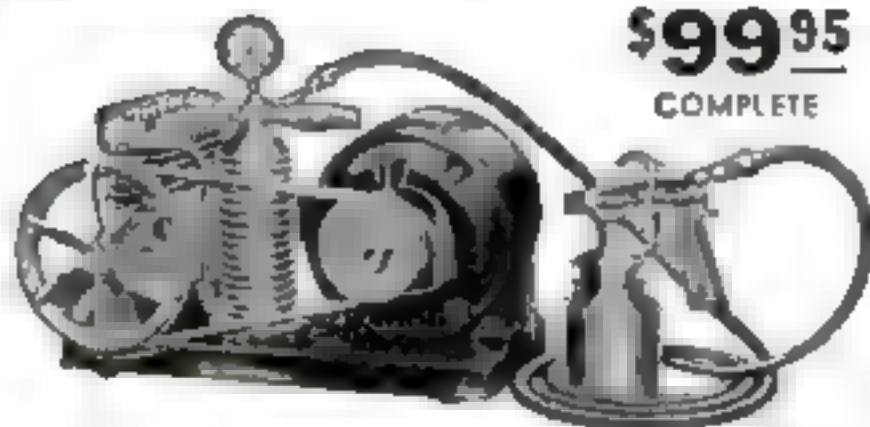
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PORTABLE AIR COMPRESSOR
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The ideal air supply for home and farm workshop, machine shop, garage, service station and contracting painter. Inflates tires; refinishes automobiles, trucks, implements and furniture. Paints buildings better, faster and at lower cost than brush work. Compressor has 4 cylinders, drop forged crankshaft, heat treated valves and pistons, bronze bearings, forced feed lubrication. 50-60 lbs. pressure without pulsation. Price includes compressor as shown, with air gauge, 15 ft. hose, spray gun and 1/4 h.p. motor; fully guaranteed. With 1/2 h.p. motor—\$109.95.

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**WON'T SET
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AMAZING POWER AND ACTION

The remarkable resiliency and strength of resinated glass fiber (250.00 lbs. per sq. in.) give WONDERODS amazing POWER and ACTION. Exclusive HOWARD Resinated Glass Fiber never gets tired, keeps alive and gives you a thrill with every cast, every strike. Built and tested in models. Buy at your sport store. **FREE TACKLE BOOK** and Pocket Fishing Calendar. Reels, Rods, Lines, Accessories, Fishing tips. Send coupon.

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Speed Sweep

THE BRUSH WITH
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*Sweeps
cleaner, faster—
Out lasts ordinary
brushes 3 to 1!*

Mail Coupon Today

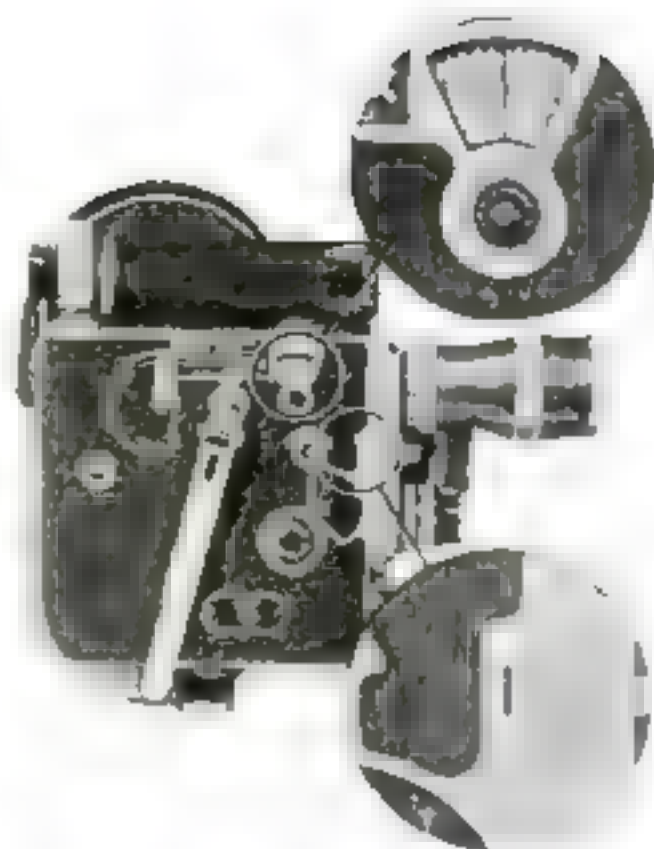
Milwaukee Dustless Brush Co.
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Please send me complete information about
Speed Sweep brushes.

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Aids for Movie Makers

A built-in frame counter and a calibrated film plane for accurate focusing are features of new model Bolex H-16 and H-8 motion-picture cameras. The frame counter, shown above in top inset, has two dials, one registering each frame up to 50, the other keeping a cumulative count. This device is said to be particularly valuable for trick work. Inset below camera shows the film plane calibration mark that provides an accurate point from which the focusing measurements necessary for close-ups may be made.



For Better Putting

THE molded plastic golf-stick grip finder shown here lines up both thumbs and keeps hands together for a firmer grip. Made of Tenite by Sterling Injection Molding, Inc., of Buffalo, the device, unaffected by perspiration, is attached by adhesive tape.



QUALITY

TABLE MODEL TILT-ARBOR SAWS

OIL IMPREGNATED BRONZE BEARINGS OR DOUBLE SHIELDED BALL BEARINGS, BOTH WITH THE PATENTED BALL BEARING TRANS-AXIAL MOTOR DRIVE

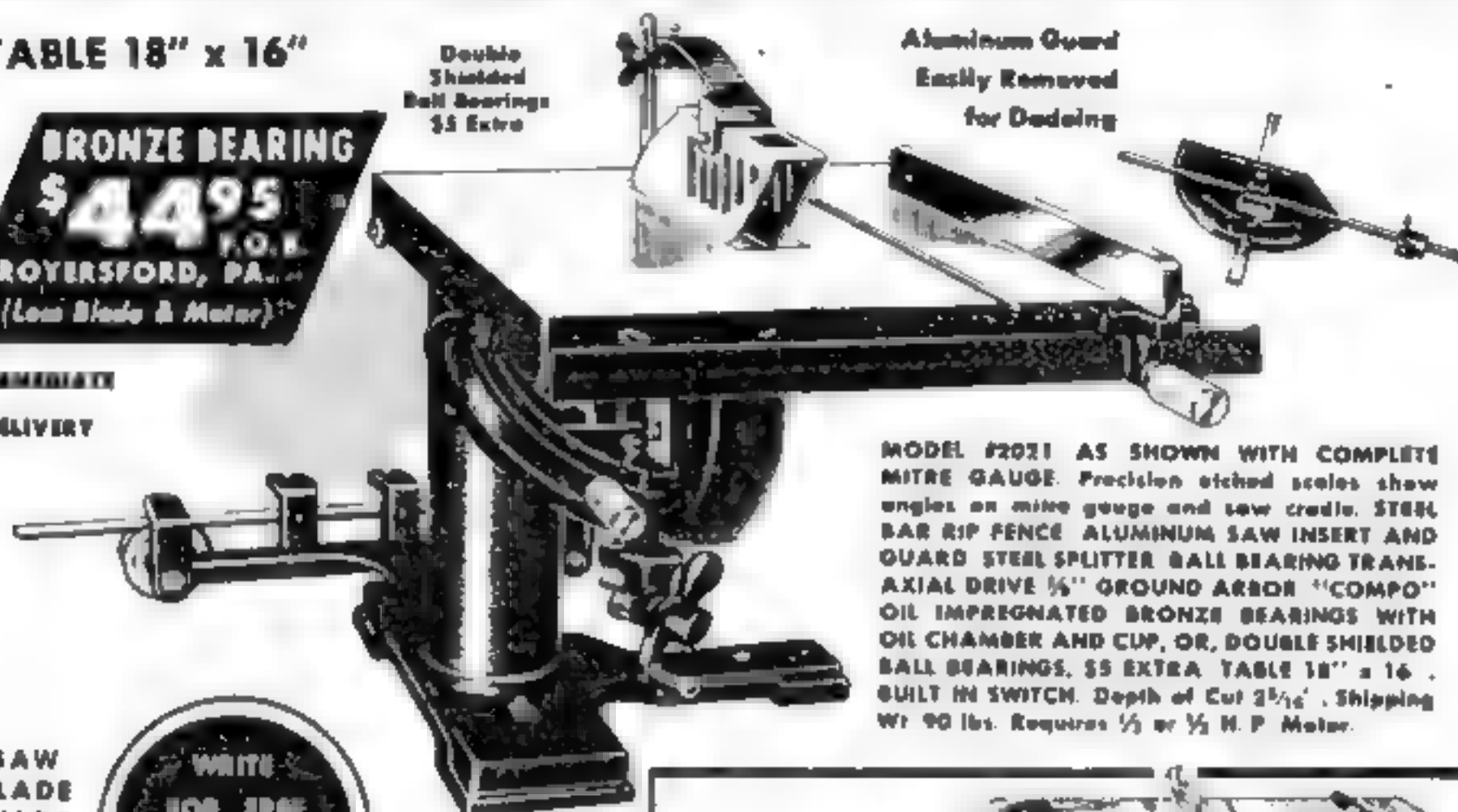
TABLE 18" x 16"

BRONZE BEARING
\$44.95
F.O.B.
ROYERSFORD, PA.
(Less Blade & Motor)

**IMMEDIATE
DELIVERY**

Double
Shielded
Ball Bearings
\$5 Extra

Aluminum Guard
Easily Removed
for Dadoing

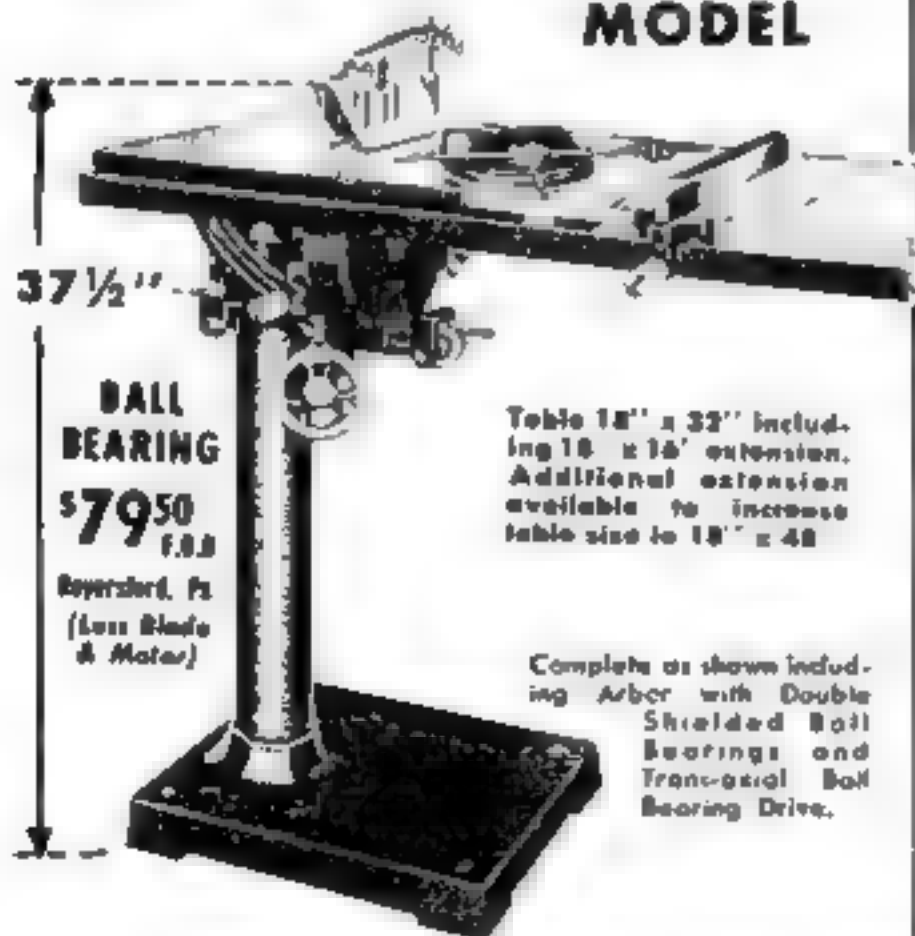


MODEL #2021 AS SHOWN WITH COMPLETE MITRE GAUGE. Precision etched scales show angles on mitre gauge and saw cradle. STEEL BAR RIP FENCE ALUMINUM SAW INSERT AND GUARD STEEL SPLITTER BALL BEARING TRANS-AXIAL DRIVE 1/2" GROUND ARBOR "COMPO" OIL IMPREGNATED BRONZE BEARINGS WITH OIL CHAMBER AND CUP, OR, DOUBLE SHIELDED BALL BEARINGS, \$5 EXTRA TABLE 18" x 16" BUILT IN SWITCH. Depth of Cut 2 1/4". Shipping Wt. 90 lbs. Requires 1/2 or 3/4 H.P. Motor.

SAW
BLADE
TILTS
•
TABLE
STAYS
LEVEL



**FLOOR
MODEL**



**BALL
BEARING**
\$79.50
F.O.B.

Royersford, Pa.
(Less Blade & Motor)

Table 18" x 32" including 18" x 16" extension. Additional extension available to increase table size to 18" x 48"

Complete as shown including Arbor with Double Shielded Ball Bearings and Trans-axial Ball Bearing Drive.

Model #2021
With 2 Extensions
Makes Table 18" x 48"

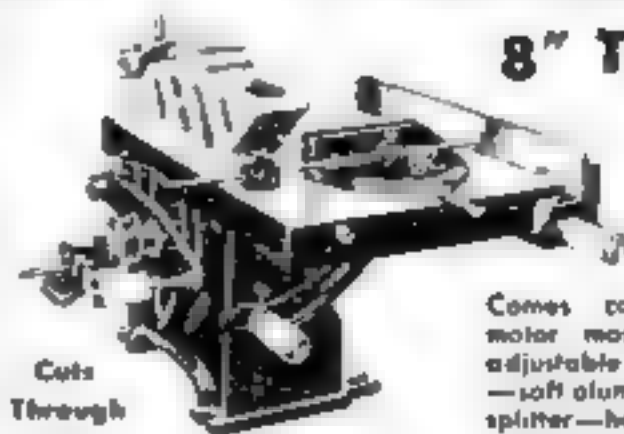


TABLES PRE-DRILLED FOR EXTENSIONS



1 EXTENSION
MAKES TABLE
18" x 32"

**8" TILT TABLE
BENCH
SAW**



Cuts
Through
2 1/4"

\$24.95
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Comes complete with Floating motor mount—mitre gauge with adjustable stop—aluminum guard—soft aluminum insert—spring steel splitter—heavy gray iron fence—(no motor—no blade). Table 12" x 14" Tilt to 45°—Oilite bearings. Shipping Wt. 50 lbs.

COMPLETE AS SHOWN

MARCUS-POLLAK

AMERICAN MACHINE & TOOL CO. INC.

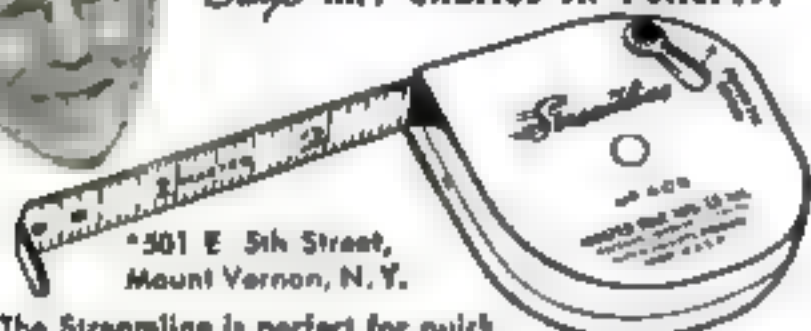
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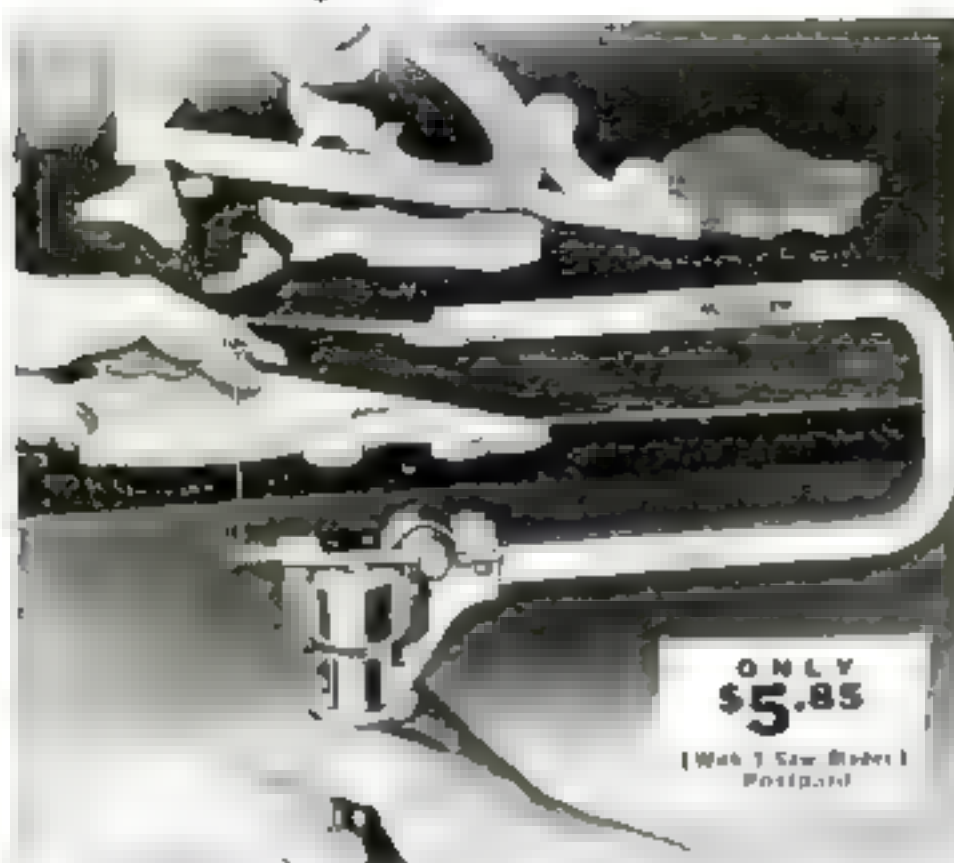
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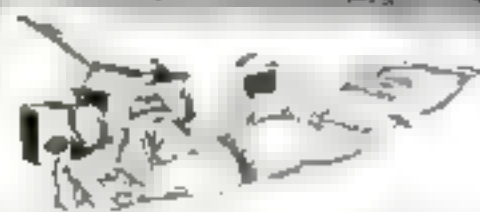
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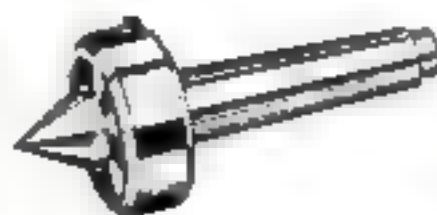
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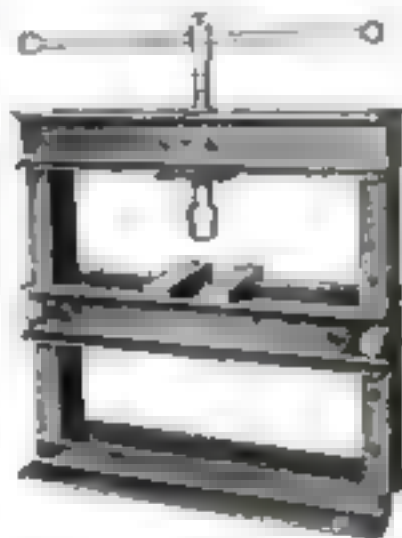
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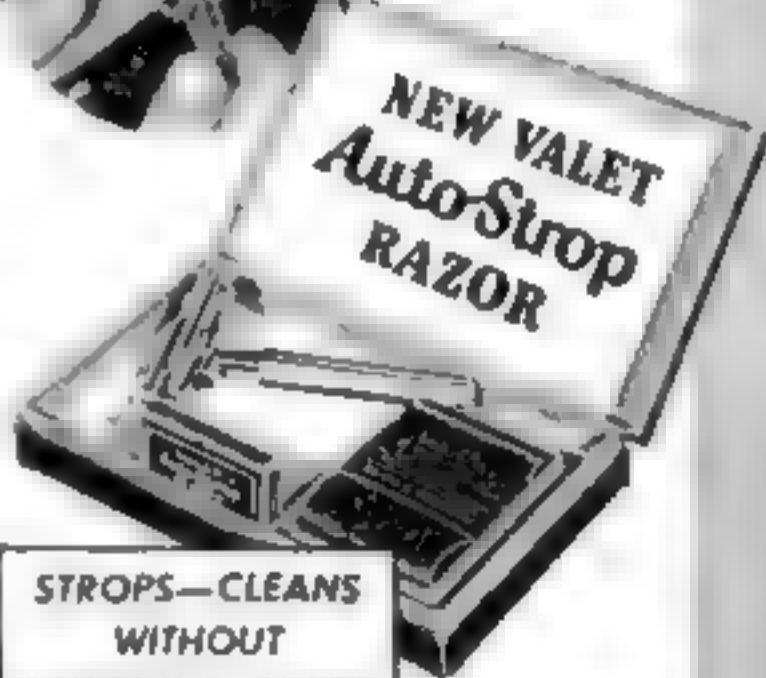
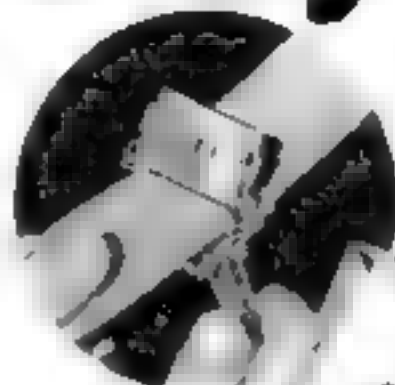
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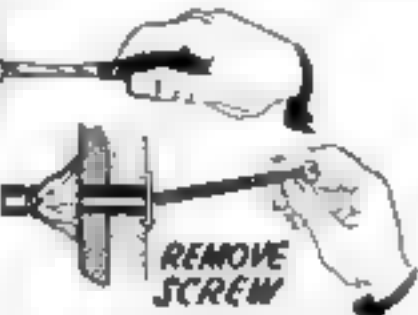


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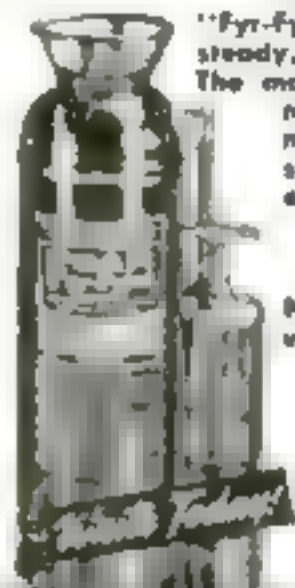
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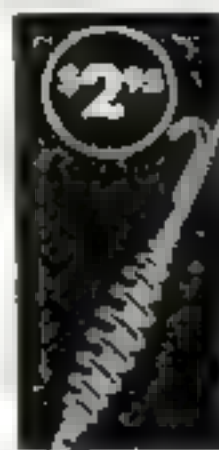


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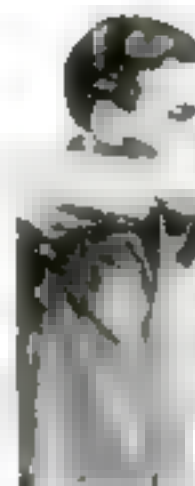
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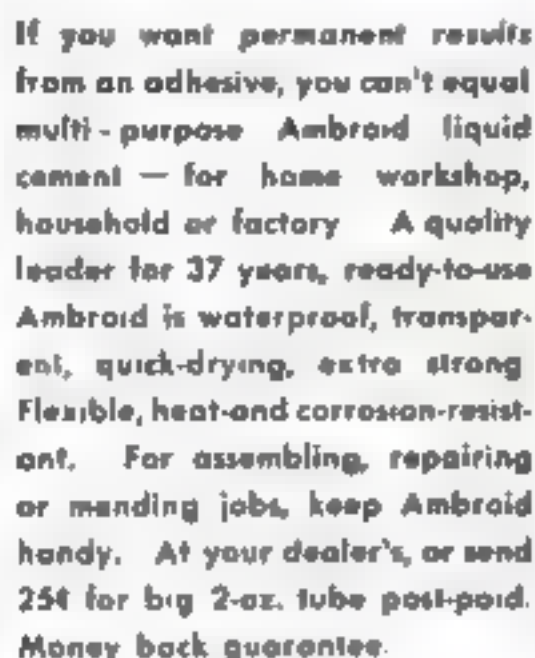
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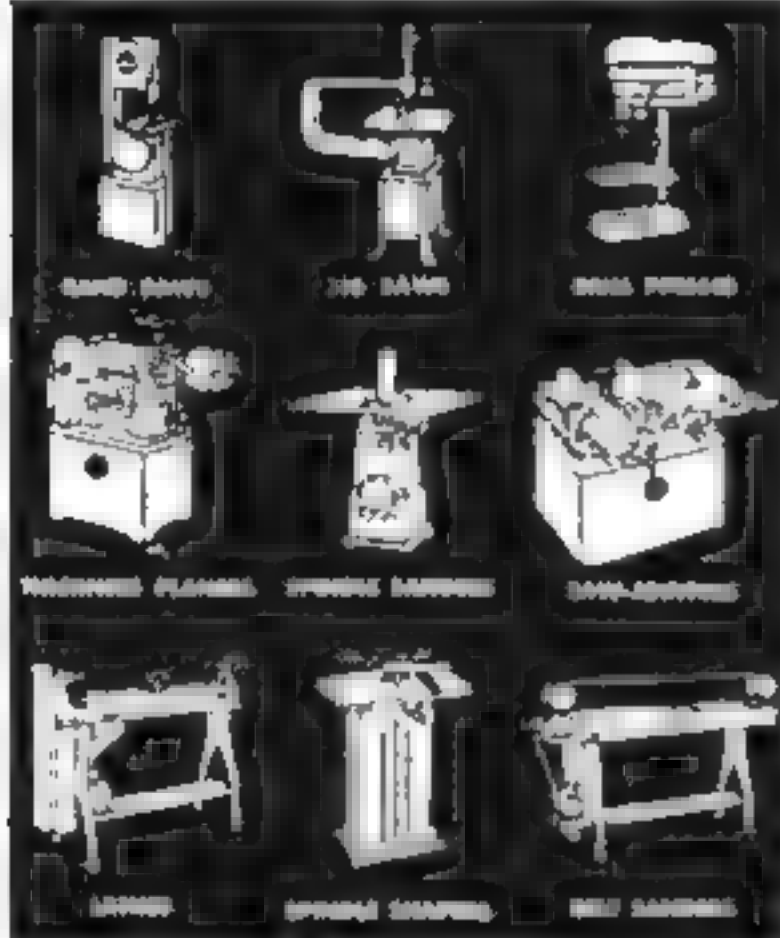
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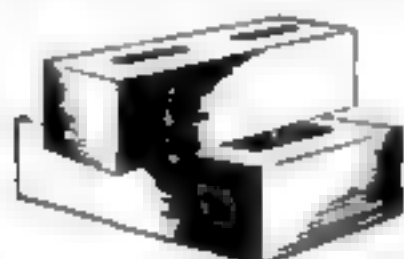
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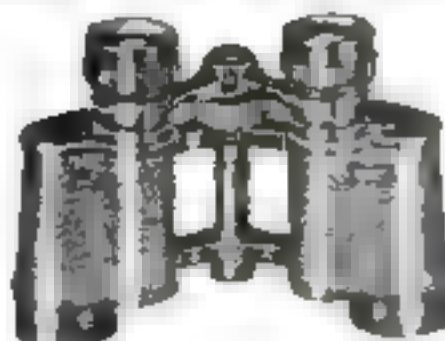
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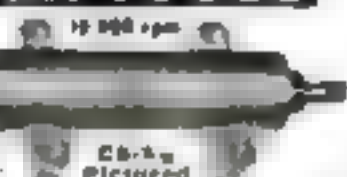
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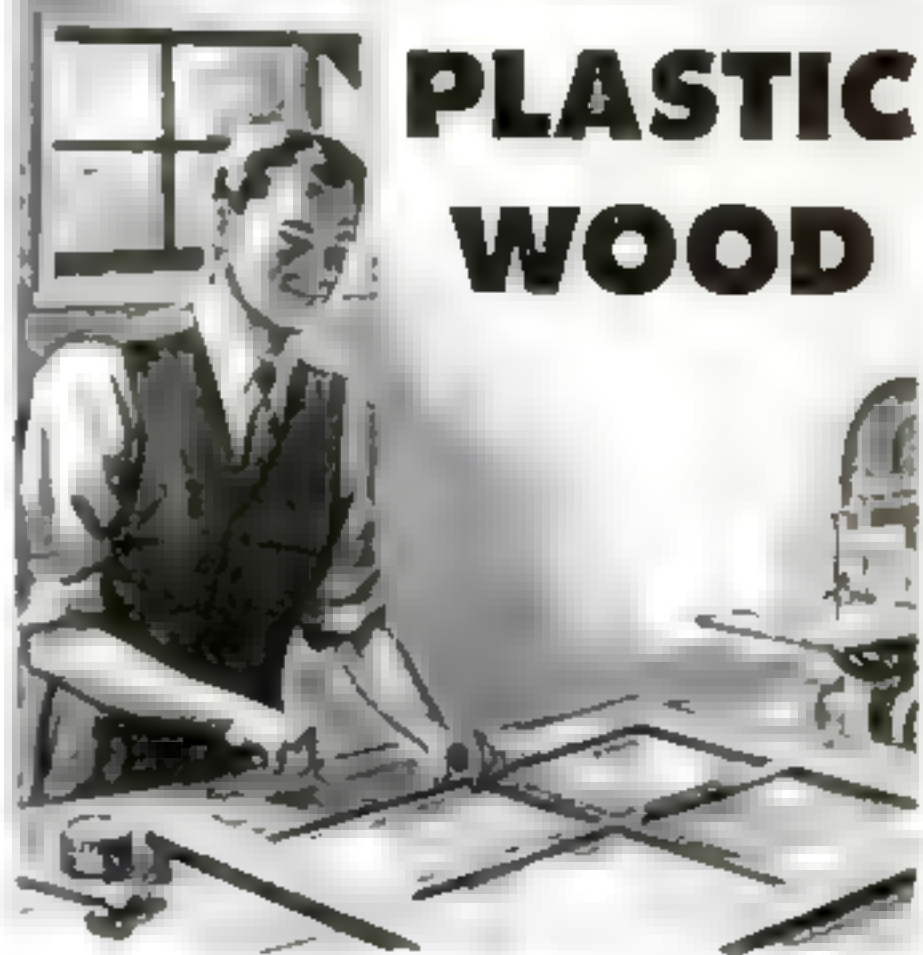
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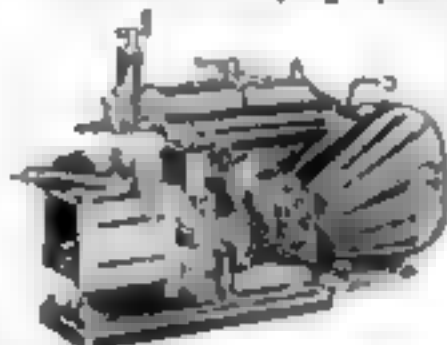
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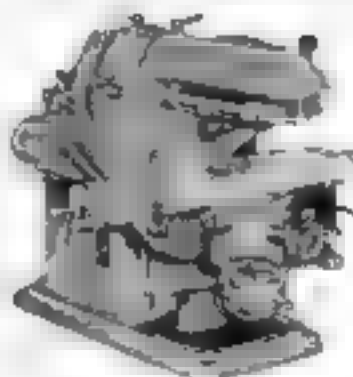
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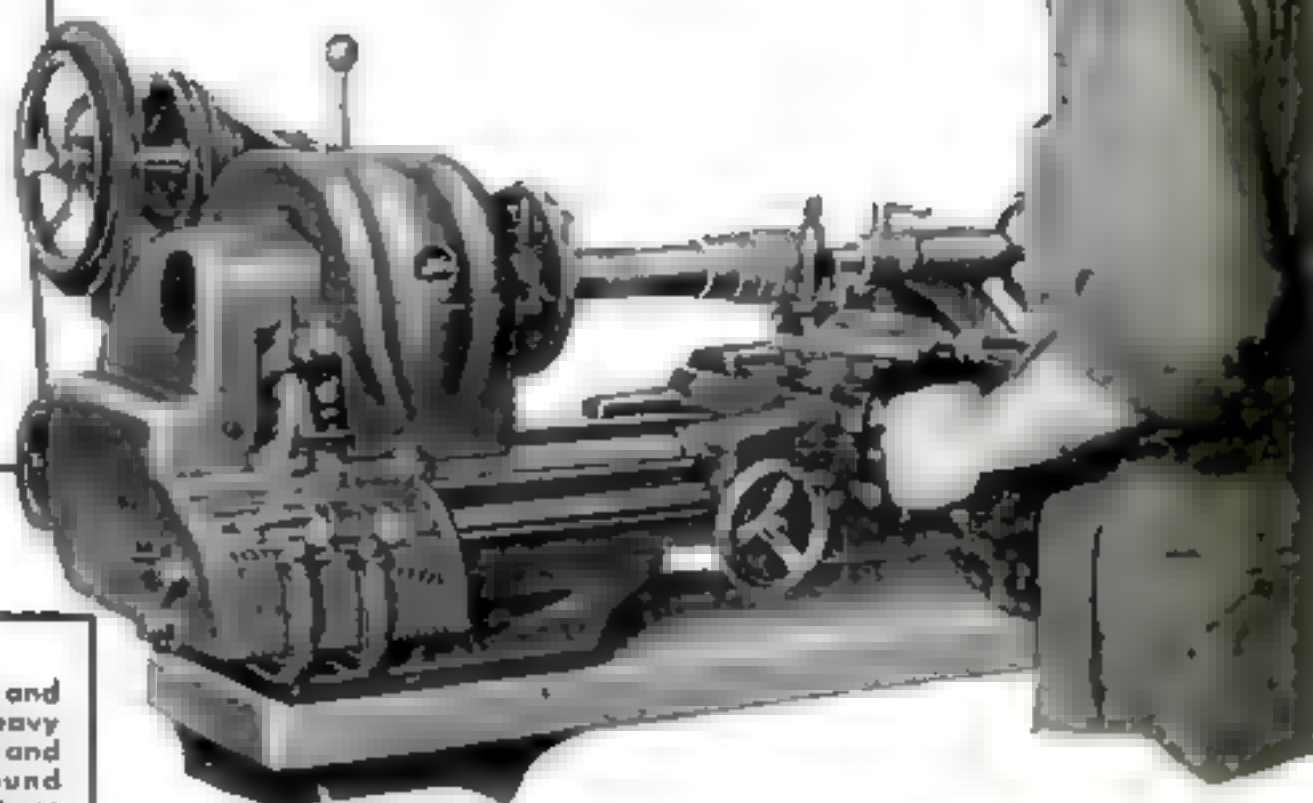


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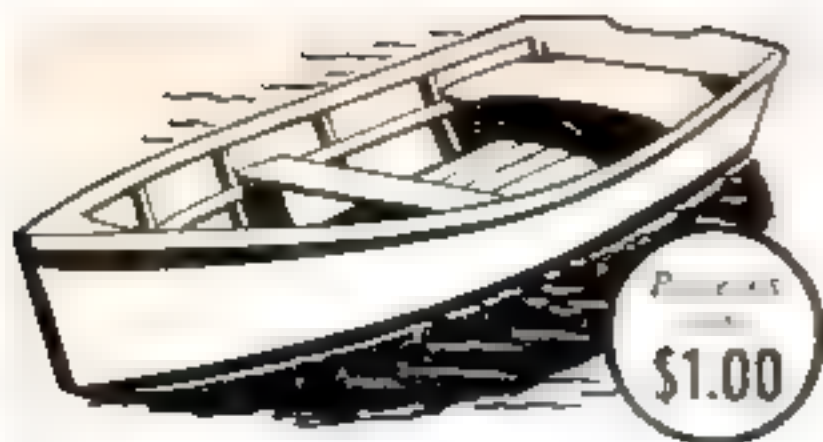
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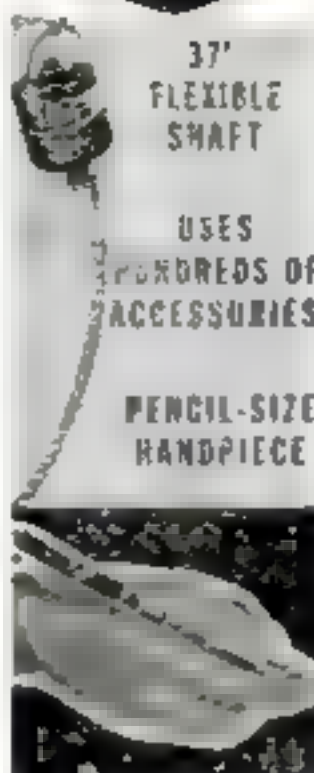
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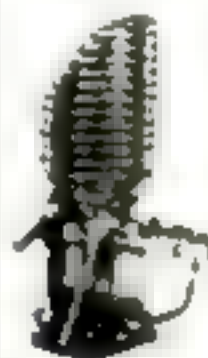


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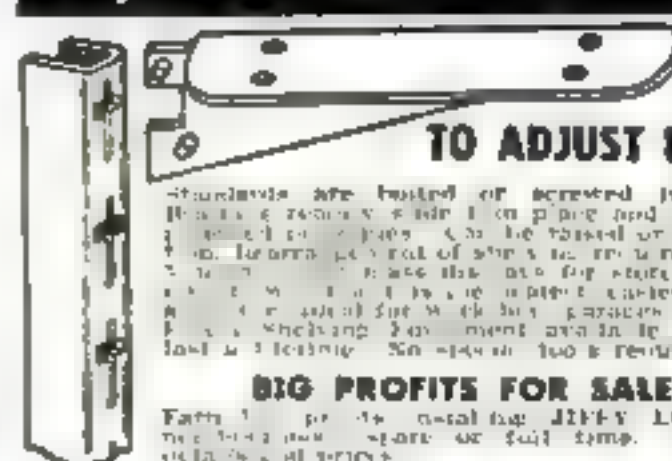
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They are made in two sizes for shelves 1584" to 1590" deep. They are made in two sizes for shelves 1590" to 1596" deep. They are made in two sizes for shelves 1596" to 1602" deep. They are made in two sizes for shelves 1602" to 1608" deep. They are made in two sizes for shelves 1608" to 1614" deep. They are made in two sizes for shelves 1614" to 1620" deep. They are made in two sizes for shelves 1620" to 1626" deep. They are made in two sizes for shelves 1626" to 1632" deep. They are made in two sizes for shelves 1632" to 1638" deep. They are made in two sizes for shelves 1638" to 1644" deep. They are made in two sizes for shelves 1644" to 1650" deep. They are made in two sizes for shelves 1650" to 1656" deep. They are made in two sizes for shelves 1656" to 1662" deep. They are made in two sizes for shelves 1662" to 1668" deep. They are made in two sizes for shelves 1668" to 1674" deep. They are made in two sizes for shelves 1674" to 1680" deep. They are made in two sizes for shelves 1680" to 1686" deep. They are made in two sizes for shelves 1686" to 1692" deep. They are made in two sizes for shelves 1692" to 1698" deep. They are made in two sizes for shelves 1698" to 1704" deep. They are made in two sizes for shelves 1704" to 1710" deep. They are made in two sizes for shelves 1710" to 1716" deep. They are made in two sizes for shelves 1716" to 1722" deep. They are made in two sizes for shelves 1722" to 1728" deep. They are made in two sizes for shelves 1728" to 1734" deep. They are made in two sizes for shelves 1734" to 1740" deep. They are made in two sizes for shelves 1740" to 1746" deep. They are made in two sizes for shelves 1746" to 1752" deep. They are made in two sizes for shelves 1752" to 1758" deep. They are made in two sizes for shelves 1758" to 1764" deep. They are made in two sizes for shelves 1764" to 1770" deep. They are made in two sizes for shelves 1770" to 1776" deep. They are made in two sizes for shelves 1776" to 1782" deep. They are made in two sizes for shelves 1782" to 1788" deep. They are made in two sizes for shelves 1788" to 1794" deep. They are made in two sizes for shelves 1794" to 1800" deep. They are made in two sizes for shelves 1800" to 1806" deep. They are made in two sizes for shelves 1806" to 1812" deep. They are made in two sizes for shelves 1812" to 1818" deep. They are made in two sizes for shelves 1818" to 1824" deep. They are made in two sizes for shelves 1824" to 1830" deep. They are made in two sizes for shelves 1830" to 1836" deep. They are made in two sizes for shelves 1836" to 1842" deep. They are made in two sizes for shelves 1842" to 1848" deep. They are made in two sizes for shelves 1848" to 1854" deep. They are made in two sizes for shelves 1854" to 1860" deep. They are made in two sizes for shelves 1860" to 1866" deep. They are made in two sizes for shelves 1866" to 1872" deep. They are made in two sizes for shelves 1872" to 1878" deep. They are made in two sizes for shelves 1878" to 1884" deep. They are made in two sizes for shelves 1884" to 1890" deep. They are made in two sizes for shelves 1890" to 1896" deep. They are made in two sizes for shelves 1896" to 1902" deep. They are made in two sizes for shelves 1902" to 1908" deep. They are made in two sizes for shelves 1908" to 1914" deep. They are made in two sizes for shelves 1914" to 1920" deep. They are made in two sizes for shelves 1920" to 1926" deep. They are made in two sizes for shelves 1926" to 1932" deep. They are made in two sizes for shelves 1932" to 1938" deep. They are made in two sizes for shelves 1938" to 1944" deep. They are made in two sizes for shelves 1944" to 1950" deep. They are made in two sizes for shelves 1950" to 1956" deep. They are made in two sizes for shelves 1956" to 1962" deep. They are made in two sizes for shelves 1962" to 1968" deep. They are made in two sizes for shelves 1968" to 1974" deep. They are made in two sizes for shelves 1974" to 1980" deep. They are made in two sizes for shelves 1980" to 1986" deep. They are made in two sizes for shelves 1986" to 1992" deep. They are made in two sizes for shelves 1992" to 1998" deep. They are made in two sizes for shelves 1998" to 2004" deep. They are made in two sizes for shelves 2004" to 2010" deep. They are made in two sizes for shelves 2010" to 2016" deep. They are made in two sizes for shelves 2016" to 2022" deep. They are made in two sizes for shelves 2022" to 2028" deep. They are made in two sizes for shelves 2028" to 2034" deep. They are made in two sizes for shelves 2034" to 2040" deep. They are made in two sizes for shelves 2040" to 2046" deep. They are made in two sizes for shelves 2046" to 2052" deep. They are made in two sizes for shelves 2052" to 2058" deep. They are made in two sizes for shelves 2058" to 2064" deep. They are made in two sizes for shelves 2064" to 2070" deep. They are made in two sizes for shelves 2070" to 2076" deep. They are made in two sizes for shelves 2076" to 2082" deep. They are made in two sizes for shelves 2082" to 2088" deep. They are made in two sizes for shelves 2088" to 2094" deep. They are made in two sizes for shelves 2094" to 2100" deep. They are made in two sizes for shelves 2100" to 2106" deep. They are made in two sizes for shelves 2106" to 2112" deep. They are made in two sizes for shelves 2112" to 2118" deep. They are made in two sizes for shelves 2118" to 2124" deep. They are made in two sizes for shelves 2124" to 2130" deep. They are made in two sizes for shelves 2130" to 2136" deep. They are made in two sizes for shelves 2136" to 2142" deep. They are made in two sizes for shelves 2142" to 2148" deep. They are made in two sizes for shelves 2148" to 2154" deep. They are made in two sizes for shelves 2154" to 2160" deep. They are made in two sizes for shelves 2160" to 2166" deep. They are made in two sizes for shelves 2166" to 2172" deep. They are made in two sizes for shelves 2172" to 2178" deep. They are made in two sizes for shelves 2178" to 2184" deep. They are made in two sizes for shelves 2184" to 2190" deep. They are made in two sizes for shelves 2190" to 2196" deep. They are made in two sizes for shelves 2196" to 2202" deep. They are made in two sizes for shelves 2202" to 2208" deep. They are made in two sizes for shelves 2208" to 2214" deep. They are made in two sizes for shelves 2214" to 2220" deep. They are made in two sizes for shelves 2220" to 2226" deep. They are made in two sizes for shelves 2226" to 2232" deep. They are made in two sizes for shelves 2232" to 2238" deep. They are made in two sizes for shelves 2238" to 2244" deep. They are made in two sizes for shelves 2244" to 2250" deep. They are made in two sizes for shelves 2250" to 2256" deep. They are made in two sizes for shelves 2256" to 2262" deep. They are made in two sizes for shelves 2262" to 2268" deep. They are made in two sizes for shelves 2268" to 2274" deep. They are made in two sizes for shelves 2274" to 2280" deep. They are made in two sizes for shelves 2280" to 2286" deep. They are made in two sizes for shelves 2286" to 2292" deep. They are made in two sizes for shelves 2292" to 2298" deep. They are made in two sizes for shelves 2298" to 2304" deep. They are made in two sizes for shelves 2304" to 2310" deep. They are made in two sizes for shelves 2310" to 2316" deep. They are made in two sizes for shelves 2316" to 2322" deep. They are made in two sizes for shelves 2322" to 2328" deep. They are made in two sizes for shelves 2328" to 2334" deep. They are made in two sizes for shelves 2334" to 2340" deep. They are made in two sizes for shelves 2340" to 2346" deep. They are made in two sizes for shelves 2346" to 2352" deep. They are made in two sizes for shelves 2352" to 2358" deep. They are made in two sizes for shelves 2358" to 2364" deep. They are made in two sizes for shelves 2364" to 2370" deep. They are made in two sizes for shelves 2370" to 2376" deep. They are made in two sizes for shelves 2376" to 2382" deep. They are made in two sizes for shelves 2382" to 2388" deep. They are made in two sizes for shelves 2388" to 2394" deep. They are made in two sizes for shelves 2394" to 2400" deep. They are made in two sizes for shelves 2400" to 2406" deep. They are made in two sizes for shelves 2406" to 2412" deep. They are made in two sizes for shelves 2412" to 2418" deep. They are made in two sizes for shelves 2418" to 2424" deep. They are made in two sizes for shelves 2424" to 2430" deep. They are made in two sizes for shelves 2430" to 2436" deep. They are made in two sizes for shelves 2436" to 2442" deep. They are made in two sizes for shelves 2442" to 2448" deep. 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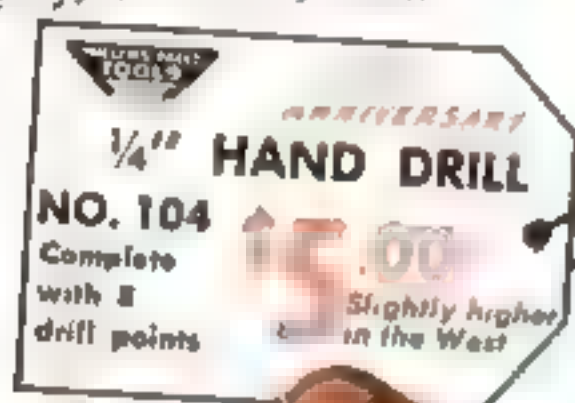
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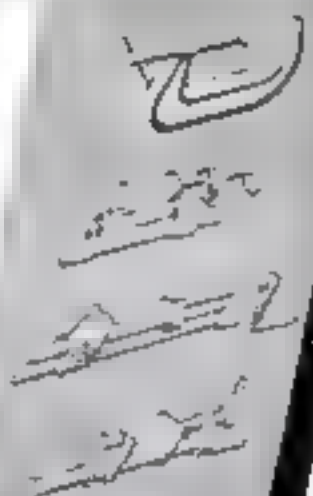
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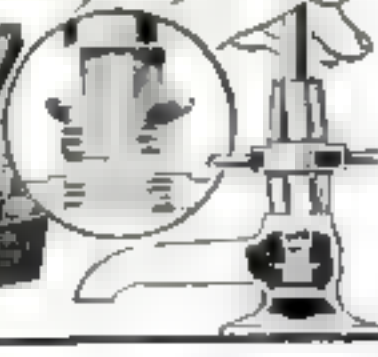
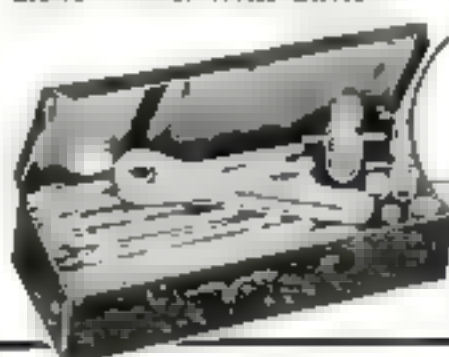
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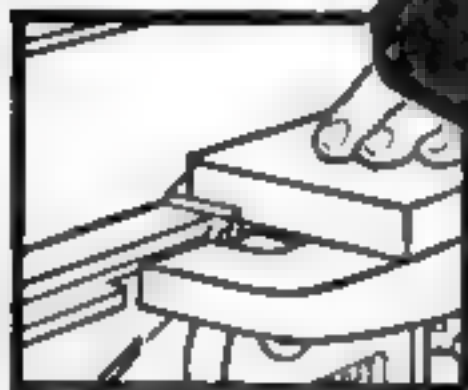
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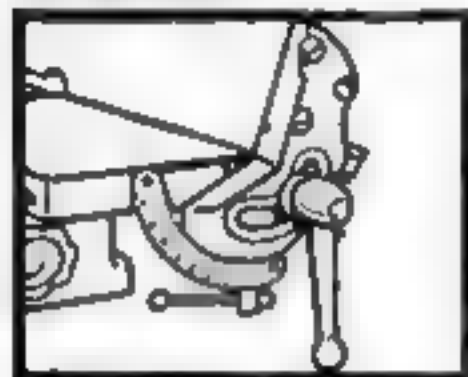
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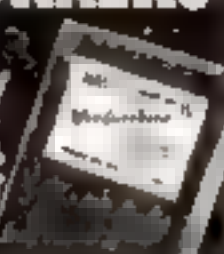
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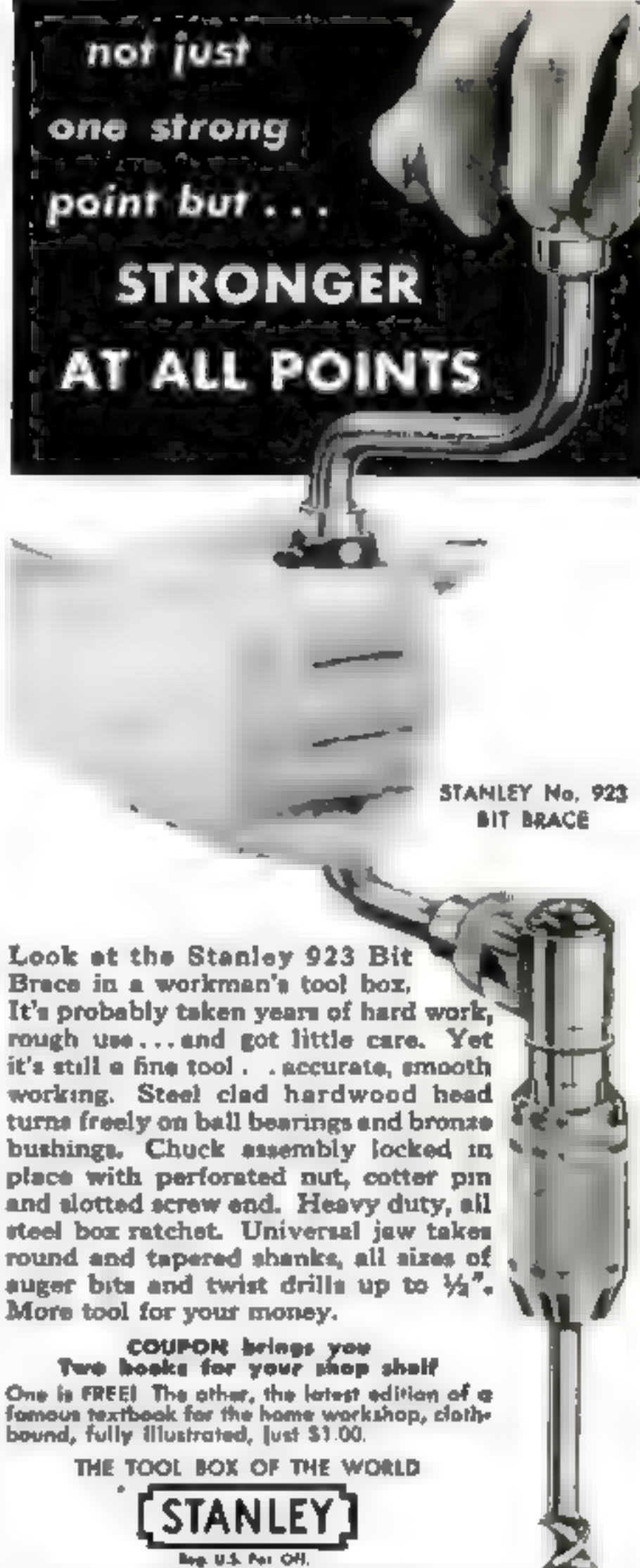


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2744x, 2746x,
2748x, 2750x,
2752x, 2754x,
2756x, 2758x,
2760x, 2762x,
2764x, 2766x,
2768x, 2770x,
2772x, 2774x,
2776x, 2778x,
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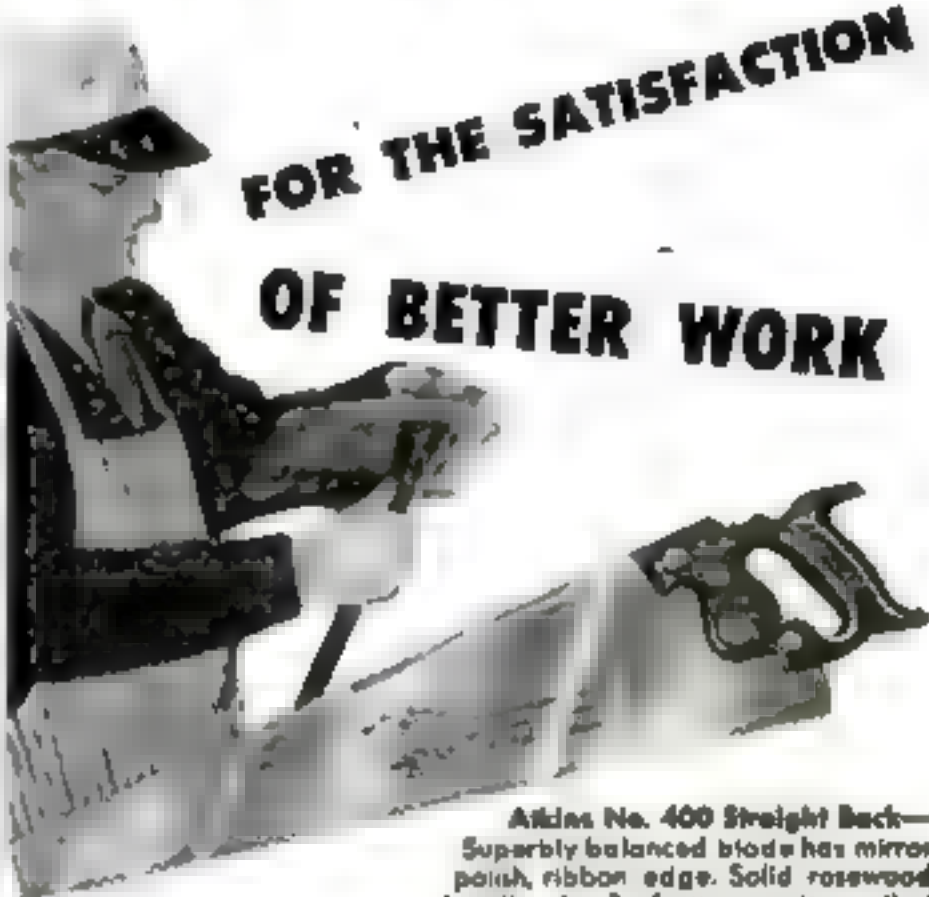
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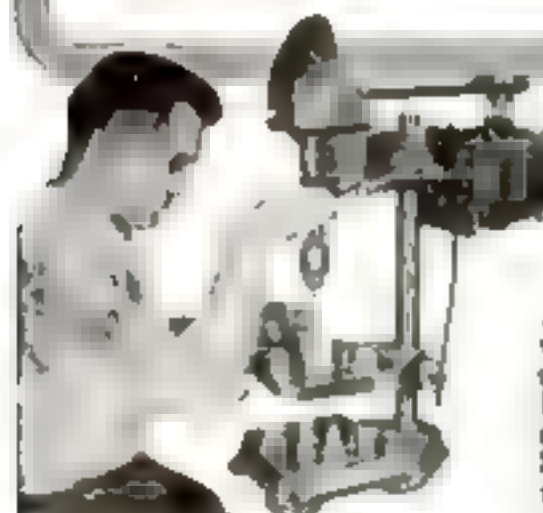
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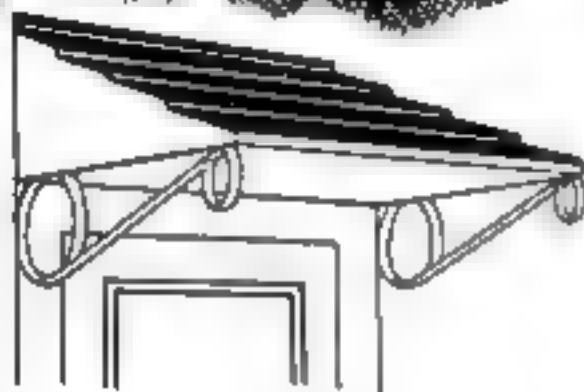
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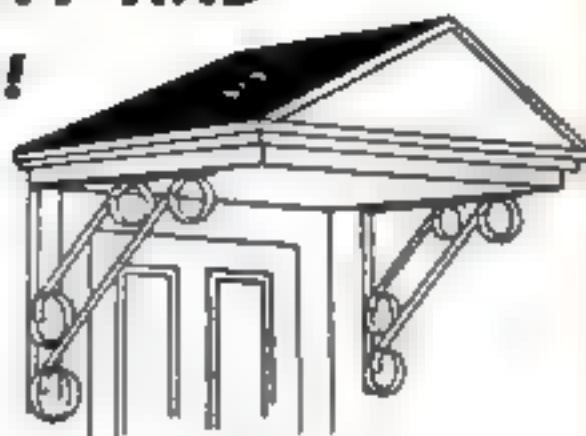
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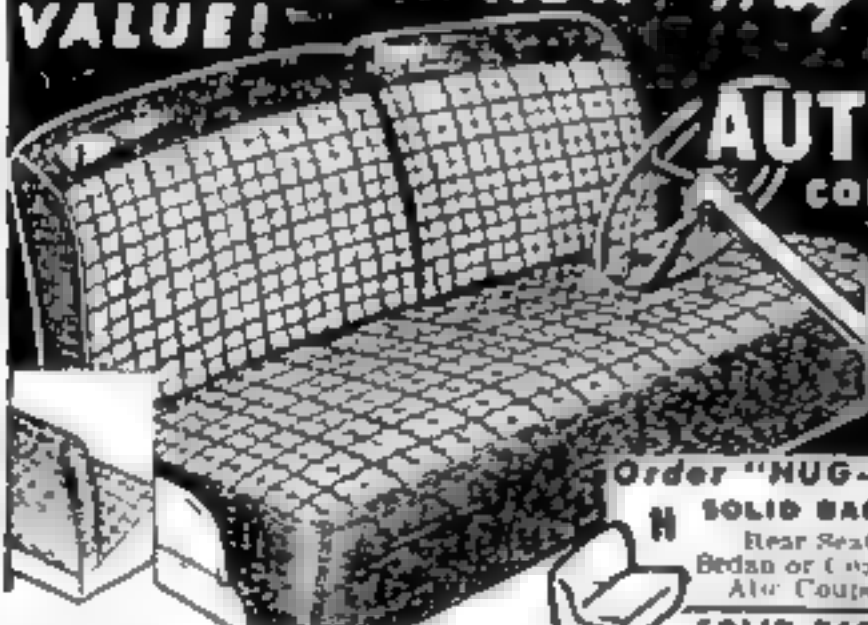
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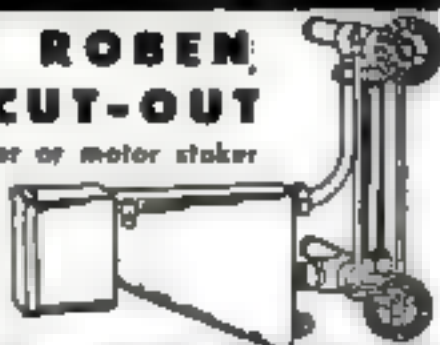
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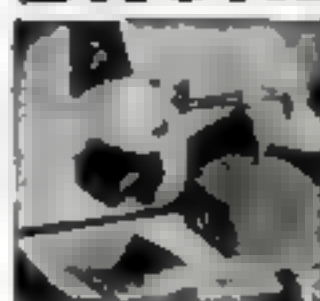
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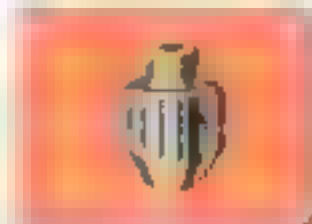
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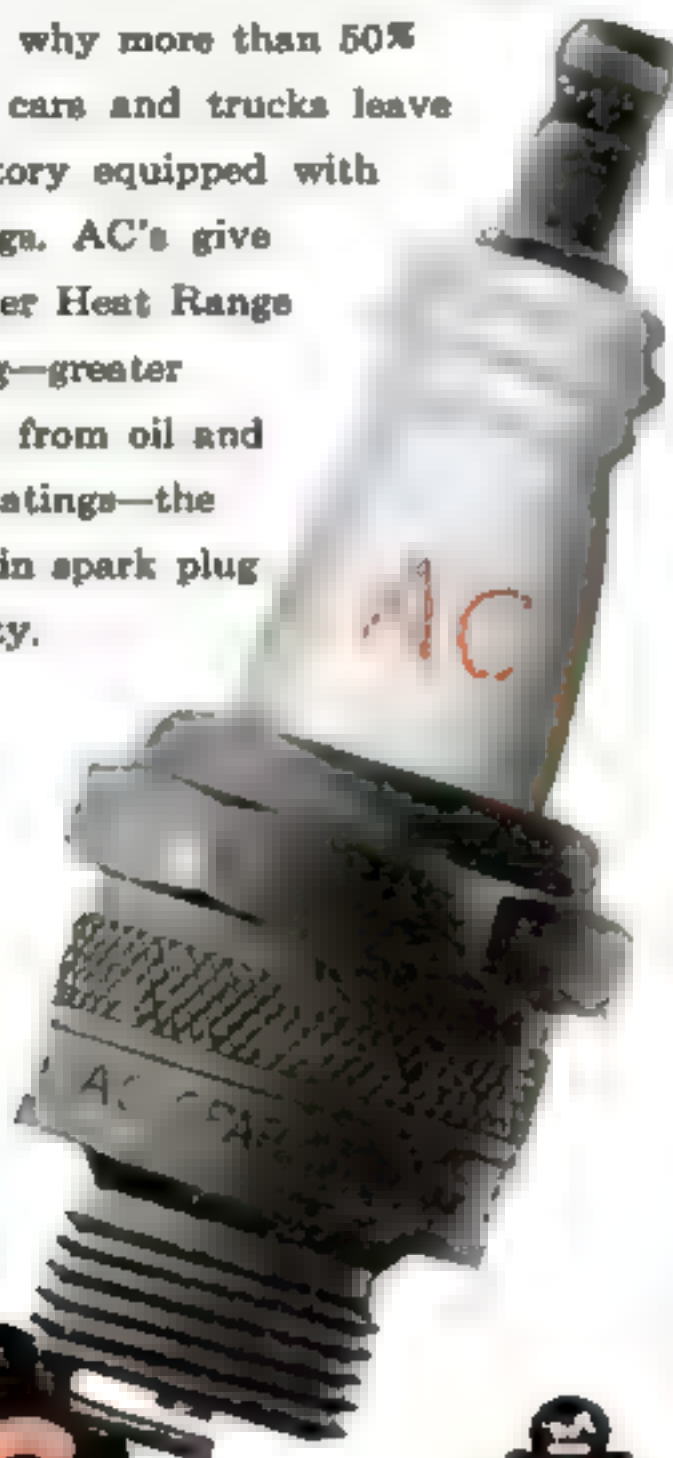
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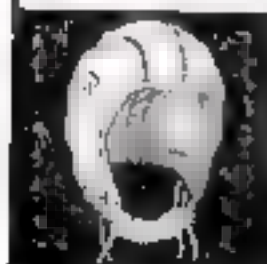
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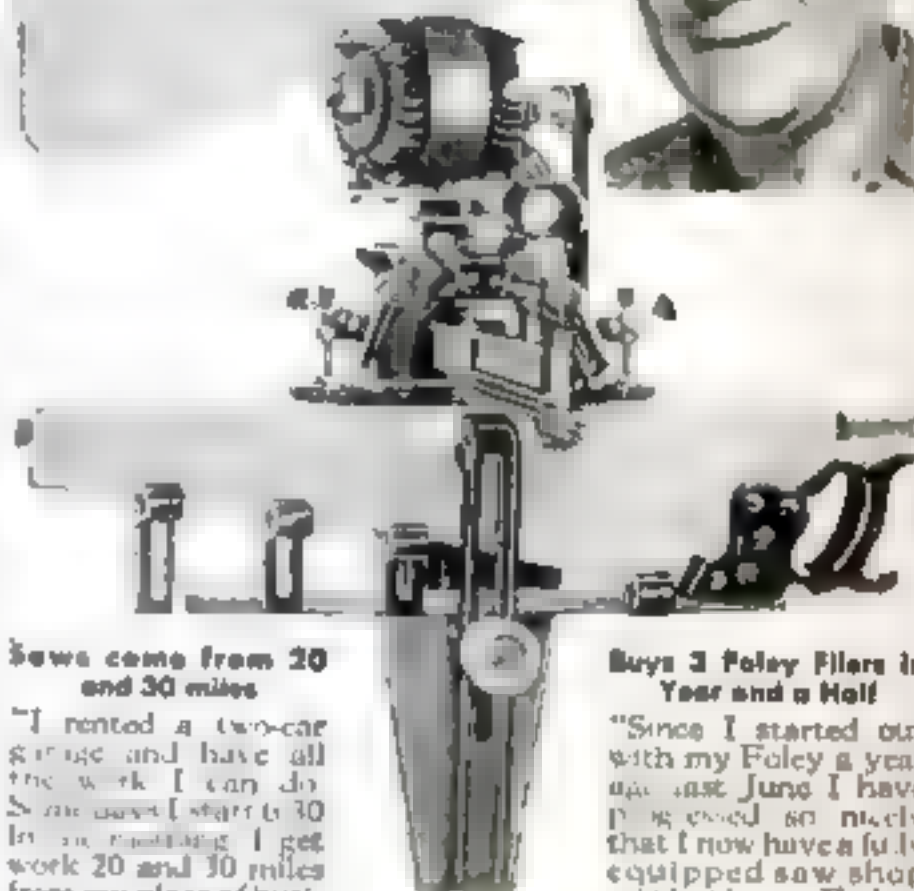
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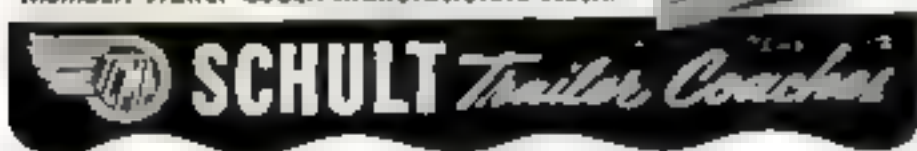
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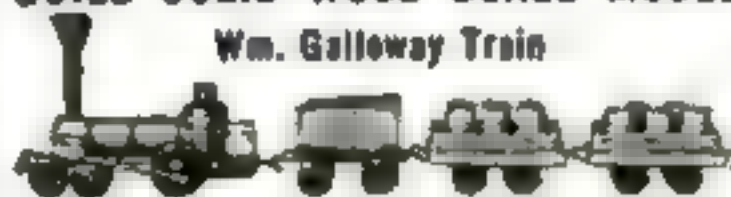
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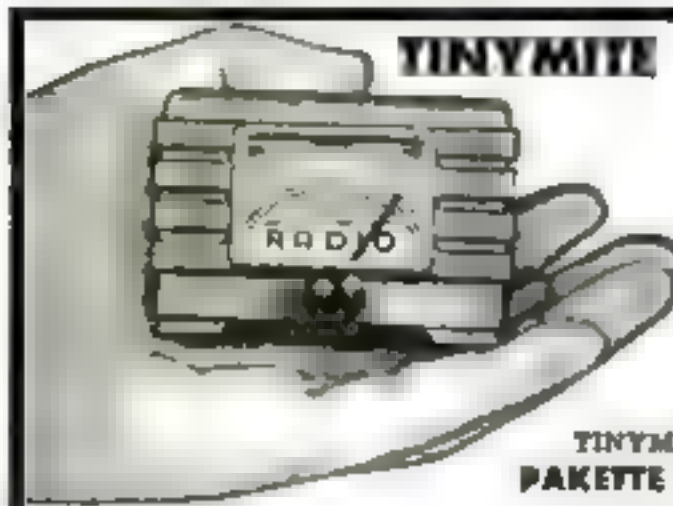
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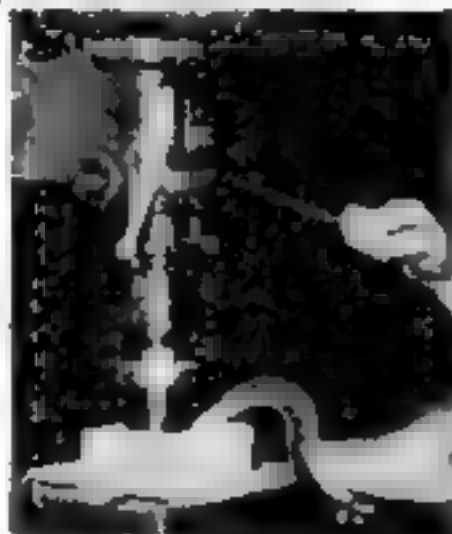
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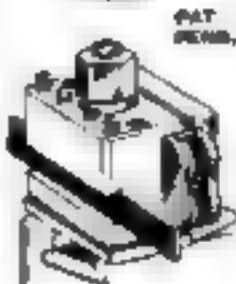
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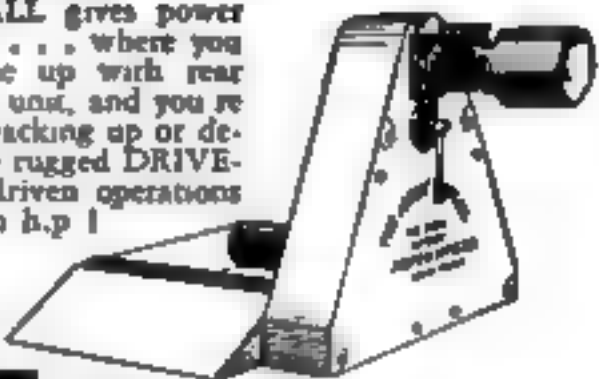
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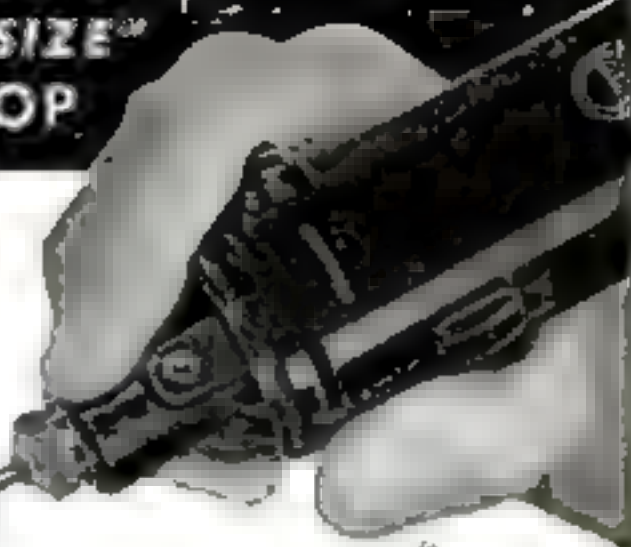
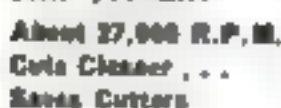
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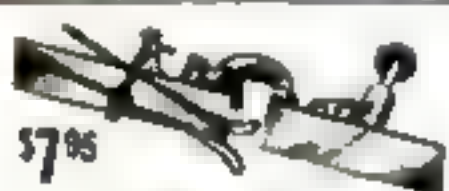


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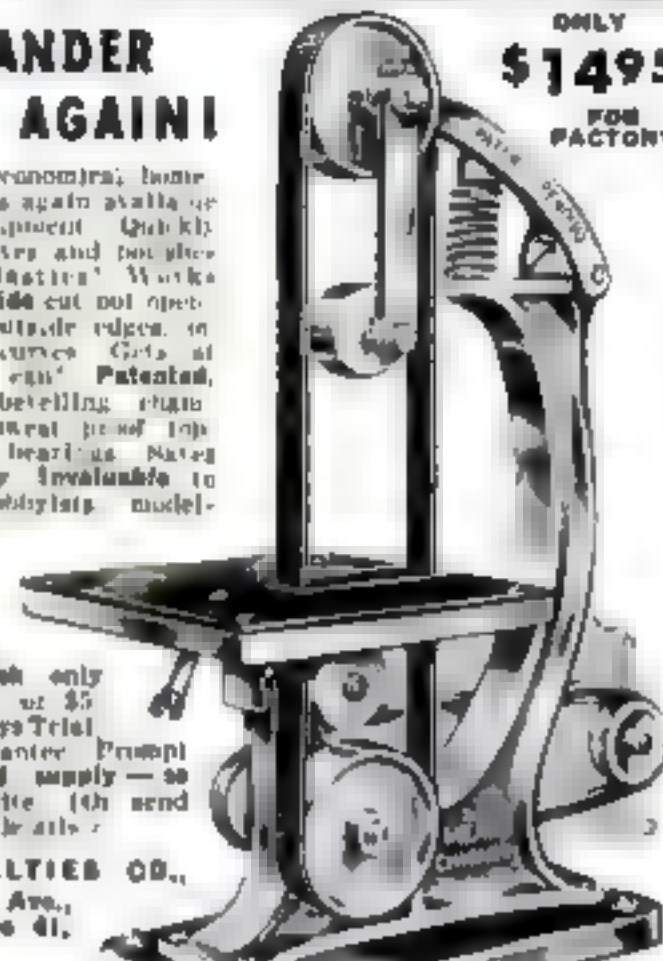
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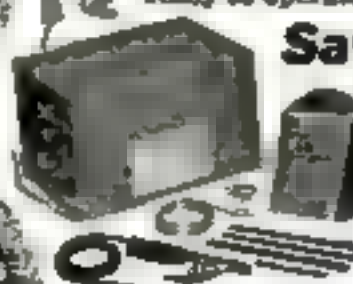
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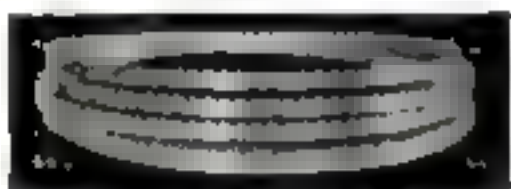
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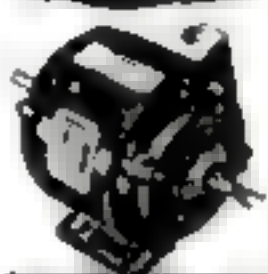
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ELECTRIC MOTOR BARGAINS!



1/2 HP GENERAL ELECTRIC or WESTINGHOUSE MOTOR, 110V AC, Fully Insulated on oil burners, refrigerators, beachers, small compressors, pumps, saws etc. Quiet-running, consumption excellent for application where high-start up torque not a requisite. Rebuilt inhouse. Your Low Cost \$19.00



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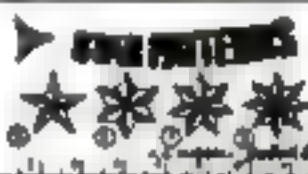
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Dries in about one hour to smooth, mirror-like professional finish.

GUARANTEED FOR 2 YEARS not to crack, chip, peel or fade, if simple directions are followed. Lustr-Wipe is NOT a wax or a polish but a marvelous new Auto Enamel.



**NO Brushing
NO Spraying
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NO Streaks**

Follow the simple instructions and LUSTR-WIPE will give your car that **FACTORY-LOOK**. Dries dust-free in about an hour. Gloss over any color enamel or lacquer.

ONE QUART PAINTS YOUR ENTIRE CAR ANYONE CAN DO A BEAUTIFUL JOB

LUSTR-WIPE is the easy, speedy, economical, yet most successful way you've ever seen to **PAINT YOUR OWN CAR**. It's different works almost like magic! All you need is **ONE QUART** of LUSTR-WIPE, the Miracle Auto Enamel, and the powder puff we send you **AT NO EXTRA COST**. Almost **ANYONE**, can do a magnificent job in about **ONE SHORT HOUR**. It seems unbelievable but true. **JUST WIPE IT ON**. No brush needed. No spray required. No masking of any kind. LUSTR-WIPE dries dust-free in about an hour. You'll be amazed—thrilled beyond words with the results! Your friends will think you spent \$75 to \$125 for a professional paint job. **YOUR CAR WILL LOOK "LIKE NEW"**. Rush your order for a quart of LUSTR-WIPE TODAY.

SEND NO MONEY! ORDER LUSTR-WIPE TODAY!

BLACK or GREY (Gunmetal Grey-Dark, Air Wing Grey-Light)	\$3.95 per Qt.
GREEN Brewster-Dark or Jewel Light)	3.95 per Qt.
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BON BEIGE (Tan)	3.95 per Qt.
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Order one quart or more today. **SEND NO MONEY!** Mail penny postcard. Then pay postman for LUSTR-WIPE plus postal charges. Or, if you send money with order, WE pay postage. See your dealer or order direct.

This Price for Immediate Delivery

**SAVE by
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ORDER ONE OR MORE
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Send for free details of powerful money-making plan. Why wait? The weather is ideal for painting cars. **START NOW BY ORDERING ONE OR MORE QUARTS OF LUSTR-WIPE TODAY!**

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Go into business for yourself selling LUSTR-WIPE in cars, or painting cars yourself or having others to do the work. Owners of old cars everywhere (who can't get new cars) are easy prospects. Send now for our **MONEY-MAKING PLAN**.

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Please send me _____ quarts of LUSTR-WIPE AUTO ENAMEL at the special price of \$3.95 per quart.
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Reader
Editor

You Don't Have To be Good To Have Fun!



IF YOUR job or hobby is deep-sea diving or jet-plane piloting, either you're good or you're dead. Watchmaking and diamond cutting call for considerable skill, too. But there are dozens of pursuits less exacting that offer something much needed these days: the thrill of accomplishment.

I have an idea that a lot of people hesitate over hobbies because (a) they think they aren't skilled enough, or (b) it's too much work.

For those who "can't drive a nail," I recommend a careful reading of Jerome Parker's lively piece on page 194, "I'm Proud of My All-Thumbs Craftwork." Not because Mr. Parker threatens Mr. Chippendale, but because he is himself an amateur with a hammer. And because he is able to pass along in print some of the sheer pleasure of making something out of nothing.

Some things need no blueprints, no fancy tools, no great skill. The personal production of even the most primitive gimmick has a thrill as a by-product. Let me tell you about MY operation . . .

Now, I can run a hammer, saw, paintbrush, and wrench, but I'm no Harry Walton. One stormy Sunday afternoon lately, I found myself with a restless six-year-old son who wanted a new belt like the beautiful hand-carved example of leathersmith art I had just picked up as a bargain. Rummaging around in my catch-all drawer, I found a half-inch leather strip, and an awl. Except for a little emergency sewing, and making a couple of crude holsters and sheaths years ago, I had never done any leather work.

But, probably by absorption from the

pages of POPULAR SCIENCE, I knew you could wet leather, push it around with a blunt instrument, and thus impress a design. So, with my awl, a knife, a dull nail, and a kitchen spoon, I set to work—ably bothered by the boy.

Here's a picture of the result an hour later. It's a "school belt" complete with alphabet impressed by said nail. The "carving" was done with the handle of the spoon. I made mistakes: getting the leather too wet was the worst. It should be dampened from the flesh side until the polished side darkens, I now know. In my ignorant enthusiasm I soaked it good. It isn't going to put Sam Myers, down in Texas, out of the harness and holster business. But my son's schoolmates are pestering their pops.

And I guess it has put me in the leatherworking business. I never knew it was so much fun and so easy to turn pennies of leather into dollars of value compared to "boughten" stuff. So now I'm shopping for leatherworking tools.

In fact, if the fun isn't enough to start you doing something with your hands, the high prices these days are a good reason for making what you can yourself. You will find many things around the house, especially the little luxuries, that cost too much to buy. You can make them, even with the high cost of materials, for half the price and less. All you need is ten thumbs and the urge. And POPULAR SCIENCE will supply the urge.

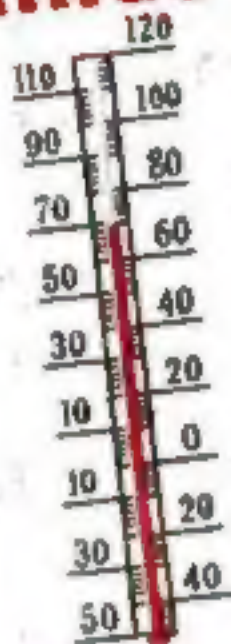
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This One



F29Q-6JJ-A5J7

SEALED POWER PISTON RINGS



**FRANCHISED
DEALER**



**EXPERT
ENGINE SERVICE**

**GET THAT "NEW CAR FEEL" AGAIN!
SEE YOUR SEALED POWER
FRANCHISED DEALER!**



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GET the same thrill from your old engine that it gave you when new—when it seemed to have wings! On some auto repair shop near you is this thermometer sign—the sign of your Sealed Power Franchised Dealer. Let him put new life in that old engine and save you a lot of money on gas and oil.

He has a set of Sealed Power Piston Rings specifically engineered to do the best possible job in your engine, whatever the make, model, or cylinder wear condition. When he gets through installing these rings, you'll thrill to that "new car feel" again.

Your Sealed Power Franchised Dealer uses

Sealed Power Piston Rings because they are the best piston rings made, the choice of engine builders for 37 years. Sealed Power Ring Sets include the famous MD-50 Steel Oil Ring—THE ONLY RING WITH THE FULL FLOW SPRING.

Send a postal for illustrated, informative new booklet on 7 ways to save oil. It's free and may save you real money. Sealed Power Corporation, Dept. H3, Muskegon, Michigan. In Canada: Stratford, Ontario.

Your Sealed Power Franchised Dealer also handles Sealed Power Pistons, Cylinder Sleeves, Valves, Water Pumps and Chassis Parts.

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BEST IN NEW CARS!

BEST IN OLD CARS!

MARCH 1948 295

SOUTH BEND 10" Precision Lathes

The 10" Swing, 1" Collet Capacity South Bend Precision Lathe is engineered for the most exacting close-tolerance machine work. The direct belt drive to the carefully balanced spindle assembly provides smooth, vibration-free speeds up to 1357 r.p.m. Slow speeds for heavy cuts on large diameters are driven through back-gears. Full quick change gear equipment makes any of 48 different threads and 48 different leads instantly available.

The precision, speed, and versatility of this lathe assures an efficient output on toolroom or

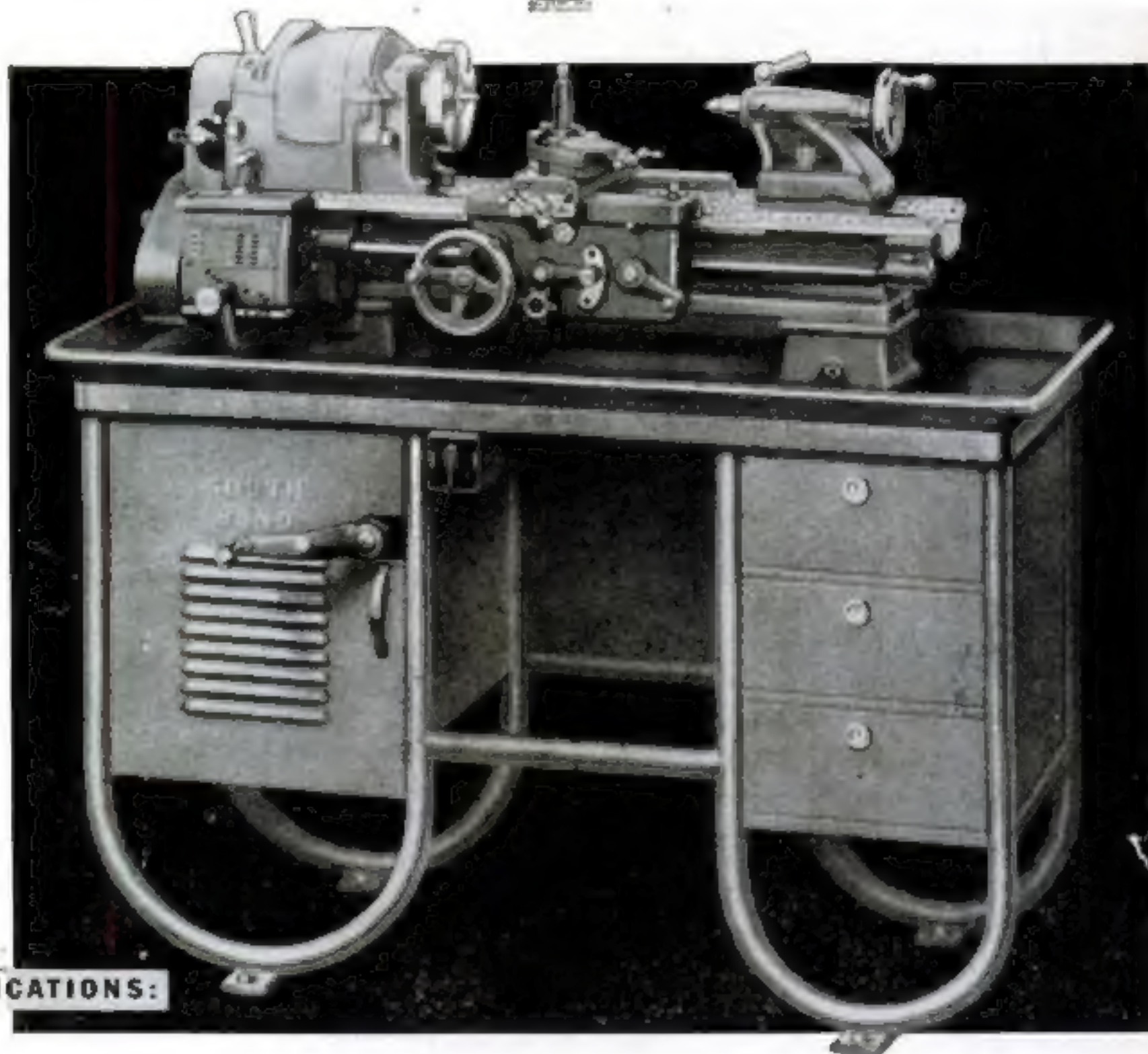
manufacturing jobs. The 1½" bore through the head stock spindle makes it especially suited for machining parts from bar or tube stock. A complete line of practical attachments greatly simplifies tooling the lathe for a wide variety of operations.

South Bend Precision Lathes are made with 9", 10", 13", 14½", 16", and 16/24" swings. We also manufacture Turret Lathes with ½" and 1" maximum collet capacity, and 14" Precision Drill Presses. Immediate deliveries can be made and a Time Payment Plan is available.

SOUTH BEND LATHE WORKS

BUILDING BETTER TOOLS SINCE 1904

456 EAST MADISON ST., SOUTH BEND 22, INDIANA



SPECIFICATIONS:

Catalog No. 187-Y5 South Bend 10"-1" Collet capacity Quick Change Gear Bench Lathe illustrated. Price—f.o.b. factory with 3 ph., 60 cy., 230 v., A.C. motor; drum switch; and bench

\$933⁶⁰

SWINGS: 10½" over bed and saddle wings, 5¼" over saddle cross slide.

BED LENGTHS . . . 3, 3½, 4 and 4½ feet

CENTER DISTANCE . . 14¼ to 32¼ inches

COLLET CAPACITY 1 inch

SPINDLE BORE 1½ inches

12 SPINDLE SPEEDS . . 50 to 1357 r.p.m.

CROSS SLIDE TRAVEL 5½"

COMPOUND REST TOP ANGULAR FEED: 2"

POWER LONGITUDINAL FEEDS: 48 R.H. or L.H.0015" to .0836"

48 POWER CROSS FEEDS: .0006" to .0309"

THREAD CUTTING: 48 R.H. or L.H. pitches 2—224 per inch

PRICE RANGE OF SOUTH BEND 10" PRECISION LATHES

Quick Change Gear Lathes . . \$718 to \$946

Toolroom Lathes \$994 to \$1186

These prices f.o.b. factory, less electrical equipment



1 I send you Soldering Equipment and Radio Parts; show you how to do Radio Soldering, how to mount and connect Radio parts; give you practical experience.



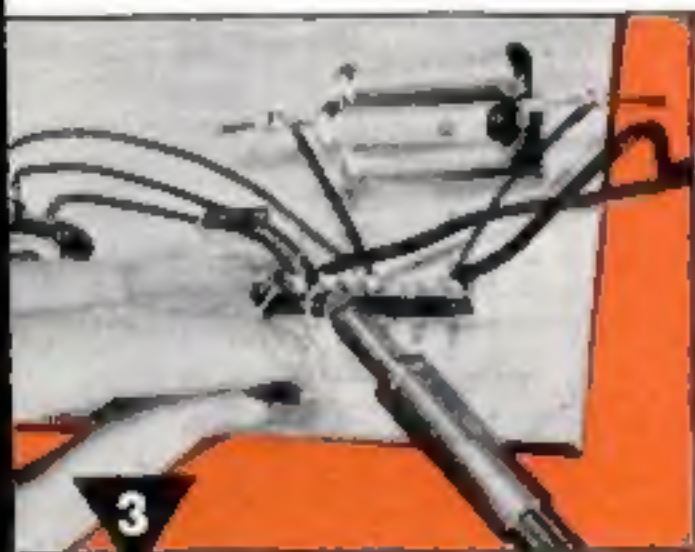
2 Early in my course I show you how to build this N. E. I. Tester with parts I send. It soon helps you fix neighborhood Radios and earn **EXTRA** money in spare time.

VETERANS

You can get this training in your own home under G. I. Bill. Mail coupon for full details.



Learn R by PRACTICING in



3 You get parts to build Radio Circuits; then test them; see how they work; learn how to design special circuits, how to locate and repair circuit defects.



4 You get parts to build this Vacuum Tube Power Pack, make changes which give you experience with packs of many kinds; learn to correct power pack troubles.



5 Building this A. M. Signal Generator gives you more valuable experience. It provides amplitude-modulated signals for many tests and experiments.



6 You build this Superheterodyne Receiver which brings in local and distant stations—and gives you more experience to help you win success in Radio.

with BIG KITS of RADIO PARTS I send you

Do you want a good-pay job in the fast-growing Radio Industry—or your own Radio Shop? Mail post card at right for a Sample Lesson and my 64-page book, "How to Be a Success in RADIO," both **FREE**. See how I will train you at home—how you get practical Radio experience building, testing Radio circuits with **BIG KITS OF PARTS** I send.

Many Beginners Soon Make Extra Money in Spare Time While Learning

The day you enroll I start sending **EXTRA MONEY** manuals that show you how to make **EXTRA** money fixing neighbors' Radios in spare time while still learning! It's probably easier to get started in Radio now than ever before, because the Radio Repair Business is booming. Think of even greater opportunities as public demand for Television, FM and Electronic devices continues to grow. Cut out and mail post card for **FREE** books now! Mail post card for Sample Lesson and **FREE** 64-page book. Read details about my Course, letters from men I trained; see how quickly, easily you can get started. No obligation! Just **MAIL POST CARD NOW!** J. E. SMITH, President, Dept. SCPJ, National Radio Institute, Pioneer Home Study Radio School, Washington 9, D. C.

FIND OUT ABOUT THIS TESTED WAY TO GOOD PAY

ALL OVER AMERICA... THE "CHOICE OF EXPERIENCE"!

More people are smoking CAMELS than ever before!



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BRANDS AND
COMPARED—IT'S
CAMELS WITH ME!

I'VE TRIED
OTHER BRANDS
—NOTHING SUITS
MY 'T-ZONE'
LIKE A CAMEL!

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ARE THE
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BETTER ALL WAYS.
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See if Camels don't
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to a T.



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pare Camels for rich, full flavor; for mild, cool smoking — and you'll agree with the millions of smokers who say that Camels suit them to a "T"!

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